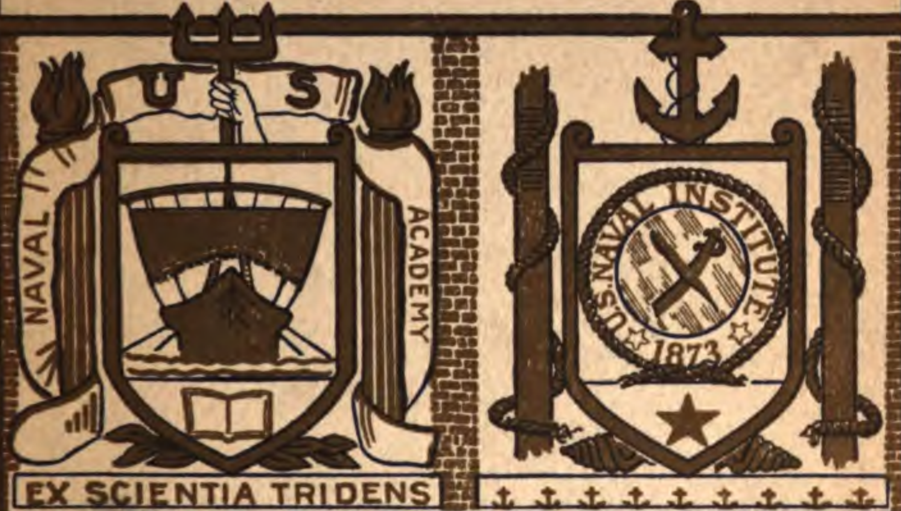
VOL. 45 JANUARY 1919 No. 191

United States Naval Institute Proceedings



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Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 1 January, 1919 Whole No. 191

United States Naval Institute Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

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JACOB VAN HEEMSKERK

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 45, No. 1 JANUARY, 1919 Whole No. 191

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AFTERWARDS!

By Lieut. Commander K. C. McIntosh, Pay Corps, U. S. Navy

Motto: "The burnt child dreads the fire."

I. The Locked Door

Some people call it luck, and some people call it providence and still others absorb all the credit to our native ability to make a silk purse out of a sow's ear. It cannot be disputed that luck was never a drawback to any enterprise; but the man, the service or the nation that depends upon future luck is apt to find himself out of it. Providence is a help we must hope for and which has been conspicuously on our side so far; but providence seems to weary of taking unceasing care of the deliberately unready. As for the third solution, our ability in the manufacture of purses is proven and undoubted; but the most ingenious methods and most superlative energy require time.

When relations with the German Empire were broken off, we were confronted with the most gigantic problem of organization ever set squarely in the path of any service. And as this was a cause which no self-respecting providence could keep its hand out of, we were given a few months instead of a few days, in which to solve it. Providence, using the British fleet as an instrument, kept the enemy from our coasts; luck reduced our mistakes to an abnormal minimum; and for some time, under wise and patient leadership, we have been delivering the goods in quantities that none of our allies had dared hope for.

We have done it by all pulling together. We have proved that a man who requires normally two or three years to train into a useful petty officer, can, under the spur of dire necessity and exceeding patriotism, become a very valuable cog in our machine in six months or less. Emergency officers have been made with amazing rapidity. They have not the flexibility of thoroughly trained men who have gained a commission through regular channels of study; but each of them has his distinct value in his own specialty, and the thing hardest to acquire—the ability to handle men—is made easier by the fact that the men who have come to us by thousands want to be handled and have made boundless allowances for the greenness of their new officers and the pressure of work on their old ones. Any officer who has censored mail since April, 1917, has indisputable proof of that. "I'm making this a short letter, Kid," wrote one youngster. "You see, some officer has got to wade through all the letters, and we need all the time the officers have got. They have my sympathy, we're certainly a bunch of Reubs at this business." They were undoubtedly, as green a crowd of men, 1100 strong, as ever gazed bewildered about the decks of a battleship, and the officers who came with them were only slightly less green. But that was in April. In July, no smarter, cleaner ship had ever gone to sea; the men at quarters presented a rigid, shining line of broad chests and square shoulders. The strained, gray look of the commanding officer and his department-heads had long ago given way to a look of pride.

Given as small a nucleus, it is impossible to imagine that we could at some future date accomplish as great results in much less time than we required during this war. In case another war should come, we cannot hope for a year or even for three months of respite while we get ready. We must have more than a moderate-sized, undermanned fleet and a wealth of raw material and untrained personnel. We cannot carry the sword about our business in peace times—for we are now fighting to end such swash-buckling, but the sword must lie ready and unrusted, close to our hand.

The final stage of cleaning up the muss after the present unpleasantness is going to leave as big a problem as the beginning gave us. The hundreds of thousands of level-eyed boys who have put through the war for us are going home. They will be ready to come back at the drop of a hat, if America needs them; but as

years pass, they will gradually cease to be a bulwark and an asset. The Civil War left us with millions of hard-bitten soldiers. The European War found us with next to none.

The discharge of the Naval Reserve will unman hundreds of ships. Of the navy crews now operating the overseas vessels, hardly 1 per cent will remain as seamen and firemen for the merchant marine. But the traffic must go on.

Demobilization and consequent placing of vessels out of naval commission will pack the yards with material in staggering quantities, every pound of it purchased at war prices, every pound of it requiring care, and every pound of it becoming obsolete as all war material will in woefully short time.

We cannot this time afford to treat this material as we have treated the residue of other wars. The permanent buildings on all Naval Reservations would not suffice to keep the perishable material out of the rain; and the country needs the return of its metals and its machines, its boats and its binoculars, as much as it needs the return of its men. America has enlisted for the war, and we cannot allow inanimate America to decay on our wharves and scrap-piles after it has done its bit. Much of this material will be immediately returnable. Raw materials and the factories to work them up can be reconverted to peaceful uses with less trouble than was necessary to convert them for war. Dismounting of guns, cleaning ship, a fresh coat of paint, and the S. P. boat becomes a yacht or a fisherman again. But what of the wooden barracks, the airplanes, the 110-footers, the guns, the schools and shops now on government land and unreturnable, the hundreds of destroyers and the fleet of former enemy ships converted into transports? If we have any idea of letting them deteriorate as we have before—if we again reduce our navy by " natural shrinkage at the top, adding nothing at the bottom"—then, brothers, no providence with any sense of humor is going to let us escape without a sharp lesson. " I've seen many wicked men and many fools," said the story-teller of Vailima. " I believe both get paid in the end, but the fools first."

Here, then, is the first staggering sight of the problem. Take one station of many, Pensacola. The sun of April 6, 1917, rose over a sleepy, blossoming garden set amid white sand, a few quarters, a few brick buildings, a hangar or two, 156 men. To-day, barely 18 months later, not only is every foot of ground inside

the gray walls used to capacity, but the great hangars, barracks, messhalls and other new construction have overflowed the walls and run down the beach a long eye-shot. Just one of the many Pensacola squadrons boasts more planes than the entire station of two years ago. Just one of the many training schools of Pensacola contains double or treble the pre-war personnel. And still, fast as it can be built and planned, the plant is just a jump behind the need, and will probably remain so to the end of the war. With another year of war, Pensacola Station would come close to being the largest industrial plant in the state. Perhaps it is now. If the war ends as other wars have ended, in complete demobilization and return to former conditions, there will not be enough personnel in Pensacola to give each building one man for a caretaker, without counting the vast accumulation of material.

Pensacola may be multiplied by 50 on this coast alone. Pelham Bay, Hampton Roads, Newport News, Quantico, these are a few that have no pre-war complement, yet they are thriving, hustling industrial cities with millions of dollars visible in material and construction. New York Navy Yard may now be said almost to comprise the waterfront from New Rochelle to Jersey City. League Island is only the heart of a vast shipyard from Camden to the bay. Norfolk Yard is but the nerve center of a corporation so huge that a little while back it would have been considered an impossible absurdity to contemplate.

Ten years ago, the back channel at Philadelphia was choked with a collection of rudimentary, Civil War monitors. We had treated them Old-Navy fashion, spending on each one annually enough red lead and grease to pay for her sale value as scrap iron. And they had absolutely no other value. The entire pre-war appropriation bill would hardly cover the preservation of our present accumulation of material; and yet the material will be there, useful for little besides war, or of no use at all unless we take serious thought right now. Twenty, 15, even 10 years from now, another emergency would find us with much obsolete junk, little serviceable stuff, skeleton personnel and no reserve, just as this one did. We must make that material *work* and produce good, tangible results in safety, and betterment for the country that paid for it. It must become an asset, and not a consumed and finished expenditure. We cannot expect to keep on hand the material necessary to fight a great war through a long period of peace.

But we can, and must, plan so that the transition from peace to war may be made in the future with less tearing up of industry by the roots. We must plan to carry such reserve of up-to-date material as will be necessary to tide us over the period of transition without delaying the start of operations. And we must have a personnel reserve that can take hold from the day of mobilization, without further delay than is necessary to throw at each man a bag of clothes, a hammock and a typhoid shot.

The ships of the Emergency Fleet will be turned over in some way to normal and lawful trade—we of the navy are not concerned in that. Those ships, however, will need men, and men for them will never be obtained under the pre-war conditions that put the Dollar Line under the Chinese flag and banished the Pacific Mail from the trans-Pacific lanes. And here the navy is interested, and vitally so. Think, brothers, what would it have meant to the part of the navy *you* began the war with, if arming and manning the merchant ships had meant only a trip to the nearest yard to mount the guns, a thunderous and unanimous "I do!" from all hands on each ship as the skipper read out the oath of allegiance, and a scamper to get out of slop-rig and into regulation blues? What would it have meant in your home yard if on April 7th of last year a thousand "limited service" mechanics had walked in through the gate and into your shops, each knowing the way to his own lathe or drill? How much younger would you be now if the first reservists who marched aboard your ship had plumped full bags down on the deck, and in response to your inquiry had saluted smartly and answered "Broadside guns, Sir. Sevens or sixes. Ten crews, complete, and 50 extra shellmen."

The other side of the picture is this—three or four million returned soldiers, three or four million munition workers, their pay envelopes suddenly stopped. During the transition and before complete relocation, there are going to be several restless people in this land. Can we help any of them?

II. The Key Hole

The war has taken the daily life of every one of us and transformed it into something we do not yet quite understand. We watch ourselves going about our daily business with a speculative wonder. Things are the same outwardly; but so subtly different

within. We feel neither discomfort nor regret—not many of us feel any conscious exaltation or setting of jaws. Things are just different, and we are surprised at how easily we have slipped into the new order which we have not yet even formulated in our minds. We know vaguely that our entire national attitude has been violently wrenched through 180°. We know that our post-war commerce, society and organization must never be again the happy-go-lucky, purblind scheme of things that made this crash possible. We know that not even an international boundary line will mean the same in the future that it has in the past. We don't know what all the changes will be, nor how they will affect us personally; but we do know that, with our newly awakened national solidarity, our new national soul, we are going to do our level best to make the reorganization a real one and a wise one and one that will make a better, stronger America and a cleaner, sweeter world. And we have realized one thing very solidly, and having realized it, have gained something worth fine gold. And that something is that UNIVERSAL SERVICE IS THE MOST DEMOCRATIC, THE MOST UNMILITARISTIC, THE MOST RELIABLE FORM OF PREPAREDNESS; AND THAT UNIVERSAL SERVICE IS THE BEST THING THAT EVER HAPPENED TO AMERICAN BOYS AND THEIR FAMILIES. Hundreds of thousands of flat-chested, timid, shifty-eyed, mouthy boys have gone to war, but not one of them will return with peace. In their place will come back quiet, level-eyed, self-respecting, broad-shouldered, self-reliant men. Hundreds of thousands of boys whose hands had no cunning have joined the colors. Very few will come back without at least the rudiments of a useful trade at their finger-tips, and this is especially true of the boys who have come to us, the NAVY. We need few "gun-toters," but we can turn out machinists and artisans by the thousand.

If we abandon universal service, be the term ever so short, after the war, we will throw away the greatest national blessing we have found so far, from the point of view not only of national safety, but also of national economy and national health and national education. And we will lose something else that has cost us much to learn. To-day, the ARMY and the NAVY are not strange collections of peculiar men, apart from the rest of us, necessary but perfectly unintelligible. The word "officer" does not mean tyrant or bully or martinet to the layman now, and the newest recruit knows before he joins what an officer is really

for—to teach, to guide, and to provide for the welfare of his men. As a nation America has learned that discipline is not to exalt the few above the many. It is to provide for the safety of the many and to place the responsibility, therefore, squarely on the officers whose *raison d'être* it is. America and her soldiers and sailors must never again become strangers to each other. Moreover, nothing but universal service is going to tide over our transition period and utilize our waste.

FOR THE SAKE OF OUR SAFETY, FOR THE SAKE OF OUR HEALTH, AND FOR THE SAKE OF OUR SOUL, LET US HOLD FAST TO UNIVERSAL SERVICE.

III. FILLING THE WARDS

We have in the navy and its branches, at present, a round half million of men. We need them, and every one of them is busy. But of that half million, a huge percentage are "one-specialty men." Ships that normally would go cheerily about their business with ten or a dozen regular officers are carrying twenty-five or thirty, not because the officers are slothful or inefficient, but because most of them are efficient only in one line, and have had no time to become proficient in others. The deck officers are good deck officers and the gunnery officers good gunnery officers; but a comparative few of the deck officers can run a gun's crew through a morning's drill period and teach them anything. It may be safely said that with a very moderate amount of *all-around* training, sixteen thousand officers and four hundred thousand men would have accomplished as much if not more than our present twenty thousand officers and half million men who have been trained for one job only.

We obviously cannot keep a regular, standing navy of four hundred and sixteen thousand officers and men. We don't want them, we can't afford them, and we have no real use for them. If we can build a reserve that can *come aboard* with the knowledge our present reserve will have when it goes ashore and musters out, we shall have found the real answer to sea-going preparedness, economy and safety. In the past we tried to bribe men into the reserve, and made the reserve so attractive that many regulars who otherwise would have stayed with us through life preferred to leave us for it. But we did *not* accumulate a trained reserve, and of our half million not 15 per cent had the vaguest idea

of what the NAVY wanted them to do when they joined us. Without the far-flung barrier of the British fleet a staggering per cent of them would never have lived to find out.

We must, then, have a regular NAVY just large enough to do our overseas business, just large enough to afford decent protection against surprise attack, to keep our fleets in readiness for business, and to form the backbone of the war NAVY. And we must have a reserve far larger than the navy itself, of trained or partially trained men, available at a moment's notice, each man plying his peaceful trade at home, but with his bag, hammock and mobilization orders stowed neatly in mothballs in the attic. When war comes, each man will shift into uniform, catch a train, walk aboard the destroyer he knows, hang his bag on the same old hook and shout into the galley, " Hey, Slim, have you learned how to cook a decent slum since I saw you last? And who's the new main gob?" Ahhh! Wake me up, someone!

A dream? Of course it is, BUT IT CAN BE DONE, and what is to the point, cheaply done! Done without a huge regular NAVY, done without a huge annual appropriation bill, done without dislocating either the patience or the pocket-book of the nation. And when it is done, merchants, manufacturers, *and mothers* will thank the NAVY for the reliable employees and clean, sturdy sons it turns out. We want no more " Snowbirds " in the navy. Give us clean boys, if only for a short time. We promise to send them back just as clean and considerably more useful to the community at large and the family pay-envelope in particular.

Rich or poor, educated or illiterate, the eighteenth birthday is a milestone in almost every boy's life. If he is lucky, he is starting or planning his college course. If he is not bound for college, he is trying to pick his trade, and only too often lack of mental and manual equipment forces him to pick a trade without a future or a decent competence. Have you ever heard of a boy of eighteen, even one who was the sole support of a family, who, in the absence of education of any sort, would not gladly embrace the opportunity to spend six months learning a trade if he could just send a few dollars a month home meanwhile? At seventeen he is too young. At nineteen he may be so settled in his job that to leave it would be a hardship; but at eighteen there is not one boy in five thousand that has not six months to spare for a profitable purpose before he starts his life work.

Immediately comes the question, "*Can* we make a really serviceable reservist in six months in time of peace?" It is true that under the pre-war system, very few boys showed much promise before the end of their first year in the service, and many had barely learned to lay out a clothes-bag for inspection in six months. There is this great difference, however. A boy who enlisted in the past, was signing up either from a desire to "see the world" or for a job. To a boy of eighteen, neither object is a stimulus to immediate study or effort; and every old-timer in the service has seen cases without number where boys with undoubted ability and plenty of advice and encouragement have lazied away the greater part of their first enlistment "getting by," hunting the soft job from deck to bridge, from bridge to fireroom, from fireroom to sickbay, and finally ending as a galley-striker. But those boys were "seeing the world," and had a three or four year term stretching ahead of them—"lots of time to get busy." Moreover, as long as they stayed off the report, they were sure of three meals a day, enough money to make an occasional liberty, and were enjoying themselves hugely with their mates. Why work and worry?

Six months under universal service presents a different aspect. A boy's future may depend entirely on what he does with those six months, and he will know it. The poor boy no longer has an apparently endless four years to learn a trade at the navy's expense. Even at eighteen, six months is not a long time; and if he wants to learn a trade he will work. Rich or poor, every boy will know that his position and chances in time of war will depend entirely on his making good during his six months' service in the active reserve. Under universal service, the NAVY could pick and choose *only the boys who wanted to learn,* at that, and the NAVY could actually become the greatest trades school in the world, and would rapidly accumulate the sort of reserve that has been the dear dream of every regular since the navy began;—sound, clean, ambitious boys, with their trades well in hand and the sea-habit at least partly acquired.

After the war we are not going to be able to keep in full commission or even in ordinary, all the vessels we have with a regular NAVY of any size that the country can afford. Neither can we afford to let them rot out of commission. Nothing will ruin a ship so quickly, and nothing is so costly in the end as to put a ship

with any usefulness left in her entirely out of commission. The active reserve is the answer.

We have fitted out and in many cases we have built from the ground up, complete and costly schools. If we revert to pre-war conditions, the majority of these will have to be abandoned, either by sale at a tiny fraction of their cost or by closing and turning over to deterioration and rats. And again the active reserve is the answer which will preserve and utilize the NAVY'S property and earn solid dividends for the country at large.

We cannot make a rolling, tar-and-rope-yarn sailorman in six months, or in two years; but we can make a very passable electrician, carpenter's mate, machinist, oiler, signalman or gun-pointer who can keep himself and his kit clean, know his way about a ship or a yard, and understand the discipline regulations. We can teach him enough in six months to make a very valuable war reservist indeed, and the knowledge thus gained will continue to make him of potential value to the NAVY for at least three years and of actual value to his community for the rest of his life. Think it over. Four months of intensive setting-up and school followed by two months of cruising along the coast in the back channel ships to fit the newly acquired school theory to sea-going practice—just straight business and no dressing ship or shore parades—will go a long way toward making a man fit to go right to work in wartime.

Now, take the case of the boy with a fair education at eighteen and the desire and ability to get more. Perhaps his father is sending him to college, and perhaps he is going to work his way through himself. He is going to have during his college course three summers to spend in loafing or working, or otherwise inviting his soul. This boy puts in his six months in the active reserve, gets the taste of salt water in his mouth and likes it. He does not want to enlist in the regular NAVY, for he intends to make more of his future than that. He has the brain and he is going to acquire the knowledge which will put him in line for a more lucrative profession. What can we do for that boy?

This is the easiest question in the whole catechism to answer. If that boy has done well during his active reserve service, has shown pluck and brain and perseverance, he may have the whole

of Annapolis to play with during the summer in the absence of the midshipmen. The NAVY will not pay him, but at his own charges he may come and grind through an intensive three months in navigation, in ordnance or in steam. He can take one course each summer. If he has completed one course he is eligible to a warrant in that line in case of war. If he has finished two, he can be made a reserve ensign; or if he has taken all three, the NAVY will muster him in as a lieutenant, junior grade, at the outbreak of hostilities. To *start* the war with a higher rank in the reserve, he must put in a year or more as a deck officer or an engineer actually serving at sea in the merchant service. Of course, during the war, he may be promoted as often as the law allows and his abilities and conduct warrant; but to begin as a lieutenant or higher, he should be able to show practical as well as theoretical officer qualities. Service as an officer in the merchant service for three years should counterbalance the Annapolis courses in this respect; and a legal requirement that a first officer's license carry with it the necessity of taking the oath and accepting a naval reserve commission would simplify our mobilization problem a great deal. It is also believed that the merchant service would gain a great many of these college- and Annapolis-trained youngsters as well.

Similarly, a boy who has the normal educational requirements and who has satisfactorily served his six months in the MARINE CORPS active reserve, may spend two summers at Port Royal or Quantico to obtain a reserve commission as second lieutenant or three summers for a commission as first lieutenant.

Boys who have thus qualified as reserve officers, NAVY or MARINE CORPS, would remain thus qualified for a period of five years after completion of courses. Boys who have merely put in their six months in the active reserve remain liable to call in the Class I Reserve for two and one-half years after discharge.

IV. A New Tenon is Necessary

One lesson of the great war which has become so trite that it is liable to be forgotten is that flying is no longer an experiment and a novelty, but is here to stay and cannot be omitted from any sane reorganization of our defenses. Every corps in the NAVY has begun hazily as a sort of supernumerary adjunct, another additional

duty; if not in our own NAVY, at any rate in the experience of others. Even the line itself, the center, backbone and real body of every NAVY in the world was once only a sort of civilian staff corps whose duty was merely to place Edward III's MARINES in an advantageous situation to fight. No corps, in this web-footed status has ever given complete satisfaction or real return for money invested. Flying is here, and flying cannot be properly attended to by watch and division officers. Sooner or later we have got to form the NAVAL FLYING CORPS on a permanent, recognized basis, and thus make it possible for a man to throw his whole energy into flying work without losing professional ground and prejudicing his future and value as a seagoing officer. When the country and the NAVY demand service, its performance should be put on an equality with any other service in point of permanence and future for the public servant engaged therein. Let us have a NAVAL FLYING CORPS, with a personnel of its own charged with all the aerial activities of the fleet and the beach. Only by making flying a main line instead of a side issue can we insure proper development and progress, and thus only can we insure ourselves of a decent supply of reserve aviation pilots, mechanics, quartermasters and gunners.

Flying is perhaps readier to receive and care for our six months active reservist than any other branch of the service. The schools are admirably equipped and ample, the balloons, dirigibles and planes are here in quantities. Six months in the schools; and thereafter boys with the present educational requirements to spend their summers qualifying as ensign-pilots—what vacations for live, adventurous boys! And what a flying reserve we could soon have!

Let the possiblilities of the FLYING CORPS gradually unfold before your mental eyes. Can we afford to let our opportunity slip? The country cannot. What we have established at a cost of millions, we can preserve at a cost of thousands. Otherwise, another emergency will oblige us to spend millions again, and probably, since we cannot again count on so long a period of immunity in which to spend them the number of millions will be multiplied many times.

V. THE FINISHED KEY

A BILL to promote the efficiency of the armed naval forces of the UNITED STATES OF AMERICA and to establish a naval reserve, and for other purposes:

Be it enacted, etc., That from and after the passage of this act the total authorized, enlisted strength of the NAVY of the UNITED STATES shall be one hundred thousand men.

That there be, and is hereby established the naval reserve, the total authorized, enlisted strength of which shall be three hundred thousand men, divided into the active reserve and the reserve. The active reserve shall consist of fifty thousand men and the term of service therein shall be six months. The reserve shall consist of two hundred and fifty thousand men who have completed their service in the active reserve, such service having terminated in an honorable or an ordinary discharge. The period of service in the reserve shall be two and one-half years. The active reserve shall consist of two classes annually, which shall be mobilized on April 1 and October 1, respectively. Each class shall consist of men who have attained their eighteenth birthday during the six months preceding date of mobilization, and shall be chosen from the semi-annual draft under the Universal Service Act.

The men of the active reserve shall, while in service, receive pay at the rate of twenty dollars and ninety cents per month, and shall be furnished with a clothing outfit consisting of one clothes bag, two suits blue uniform, three suits white uniform, four suits underwear, four pairs socks, one neckerchief, one blue cap, two white hats, one jersey and one overcoat, and a further outfit of one hammock, one mattress, two mattress-covers and two blankets. Upon discharge, the overcoat, hammock, mattress, mattress-covers and blankets shall be returned, but the balance of the clothing outfit shall be retained by the man himself, and he shall be responsible for its preservation during his term of service in the reserve.

The men of the reserve shall receive no pay during such service unless called to active duty. They shall be required to keep the Navy Department accurately informed of their whereabouts and are subject to call into active service at any time during their

the school of application will be rated as eligible in time of war to commission as ensign in the NAVY or the NAVAL FLYING CORPS, or as second lieutenant in the MARINE CORPS, as the case may be, will be added to the reserve officers' list, and will remain thus subject to call into service at the discretion of the President of the United States for a period of five years from the termination of the second three months' course of study.

That men who have satisfactorily completed three courses of three months each in the Naval Academy, the flying schools or the school of application will be rated as eligible in time of war to commission as lieutenant, junior grade, in the NAVY or the NAVAL FLYING CORPS or first lieutenant in the MARINE CORPS, as the case may be, will be added to the reserve officers' list, and will remain thus subject to call into service at the discretion of the President of the UNITED STATES for a period of five years from the termination of the third three months' course of study.

That during the three-months' course of study authorized above, students shall receive a ration, but no pay or allowances; but instruction shall be free, and the Secretary of the Navy is empowered to furnish such students with quarters if they be available, under such regulations as he may prescribe.

That for purposes of obtaining admission to the reserve officers' list, one year served as deck officer or engineer or as cadet in actual sea service in the merchant marine shall count the same as one course of study at the above-mentioned schools, two years as two courses, or three years as three courses.

That to obtain admission to the reserve officers' list with a rank higher than that of lieutenant, junior grade, in the NAVY, in addition to the three courses above outlined or their equivalent in the merchant service, the candidate must have served at least one year as deck or engineer officer at sea in an ocean-going ship.

That from and after the passage of this act, no candidate shall be issued a license as first officer in the American Merchant Marine unless such candidate take oath of allegiance and accept eligibility and liability to call into naval service as an officer in time of war.

That the Secretary of the Navy is empowered to add to the reserve officers' list such master mariners who may apply and who can show such professional, physical and moral qualifications as the Secretary of the Navy may prescribe, as eligible to com-

mission in time of war, up to and including the rank of lieutenant commander in the navy.

That no officer on the reserve list other than former or retired officers of the regular NAVY shall be carried on such list as of eligible to higher rank than lieutenant commander.

Be it further enacted, That in case of war or threatened war, when in the discretion of the President of the UNITED STATES it becomes necessary to call the reserve of the NAVY, the naval flying corps or the marine corps into active service, all members thereof shall receive the same pay and allowances as men of similar ratings in the regular establishment, pay and allowances to begin from and including date of reporting at mobilization center and to terminate with mustering out of active service.

That the number of authorized officers of the NAVY, MARINE CORPS and NAVAL FLYING CORPS, and their respective reserves, shall be governed by the percentages laid down in the act of August 29, 1916.

That all laws and parts of laws inconsistent with the above are hereby repealed, *provided* that nothing in this act shall be construed to reduce the pay and allowances of any person now in the service.

VI. THE DOOR OPENS

Gentlemen of the NAVY, would you willingly return to the old days—the days when a glimpse of your uniform on the street or of your sword-case when travelling provoked immediate derision of the passer-by; the days when you felt it impossible to understand or be understood among shore-going men of your age when any question of our national life arose in conversation; the days when your whole prayer was, " When war comes, let me live long enough to hold 'em back till the country is ready? "

You would not. The intimate acquaintance of America with her soldiers and her sailors is too precious to all of us to give up.

If we know that ashore, working away at their own business, which is the country's prosperity, there are hundreds of thousands of lads that know our life and speak our language and stand ready at the blink of an eyelash to rush to us as a rallying point, with knowledge of their duties worthy of their bravery and sacrifice, we can go cheerily about our post-war business of police and preparation with light hearts.

Will this key unlock the door which has shut us away from the life of our own people in the past? Or have you another, better one?

Brothers, upon our thoughts and plans of to-day the far-flung sea-borne life of our beloved AMERICA may depend in future years. Let us be ready, when the beast is caged and peace returns to a tattered, but glorified world, to meet the problems that peace will bring. By our solution will our children's children judge us.

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SOME EXPLOITS OF THE OLD DUTCH NAVY

By LIEUTENANT H. H. FROST, U. S. Navy

To-day we are fighting what we confidently believe to be the last battle in Europe against autocracy and tyranny. A little over 300 years ago the first great battle in the cause of democracy and freedom was being fought. The United Netherlands under the skillful guidance of that great patriot, William the Silent, and later of the great military leader, Maurice of Nassau, and the great statesman, John of Olden-Barneveld, was fighting the great military power of that day, Spain. First Elizabeth and then Henry of Navarre came to the aid of the Dutch, but always in such a half-hearted way that the bulk of the fighting fell upon the sturdy Netherlanders, who were equal to every demand which a most cruel and bitter war could make upon them. The estimate of the situation made by the English Council in the year 1584 was so strikingly similar to that which our leaders might well have made in January, 1917, that I think it will have some interest for you. It ran as follows: "The conclusions of the whole was this. Although her Majesty should hereby enter into a war presently, yet were she better to do it now, while she may make the same out of her realm, having the help of the people of Holland, and before the King of Spain shall have consummated his conquests in those countries, whereby he shall be so provoked by pride, solicited by the Pope, and tempted by the Queen's own subjects, and shall be so strong by sea, and so free from all other actions and quarrels,—yea, shall be so formidable to all the rest of Christendom, as that her Majesty shall no wise be able, with her own power, nor with the aid of any other, neither by land nor sea, to withstand his attempts, but shall be forced to give place to his insatiable malice, which is most terrible to be thought of, but miserable to suffer."

There were many other points of similarity between the two wars which I might point out to you. The Duke of Palma, a man of great military genius, was the Hindenburg of that time. There was a great siege of Antwerp; Brussels was captured; and a great victory was won by Prince Maurice on the very dunes of Nieuport where the battle line on the western front to-day meets the North Sea. It is not only in our war that great and startling inventions were used. Listen to the words of the Duke of Palma: "They are never idle in the city. They are perpetually proving their obstinacy and pertinacity by their industrious genius and the machines they devise. Every day we are expecting some new invention. On our side we endevour to counteract their efforts by every human means in our power. Nevertheless, I confess that our merely human intellect is not competent to penetrate the designs of their diabolical genius. Certainly, most wonderful and extraordinary things have been exhibited, such as the oldest soldiers have never before witnessed." Even Elizabeth's words of advice to the Dutch Ambassadors have their value to us now: "In the next place, as you know that I am sending, as commander of the British troops, an honest gentleman, who deserves most highly for his experience in arms, so I am also informed that you have also on your side a gentleman of great valour. I pray you, therefore, that good care be taken lest there be misunderstanding between these two, which might prevent them from agreeing well together, when great exploits of war are to be taken in hand."

But it is not of the Dutch victories on land and in the council chamber that I wish to tell you. They are well known. It is of the exploits of the Old Dutch Navy that I wish to talk, for the Netherlanders on the sea surpassed even their comrades in the army and in the diplomatic service; and their deeds of valor and skill, although they can be seen but dimly as we look back across the centuries, still have their lesson for us to-day. Admiral Mahan and Julian Corbett have just recently brought to our attention the histories of the British and French navies, and these able historians have also covered the later history of the Dutch Navy, so that we are all quite familiar with the fine figures of Tromp and De Ruyter and the Netherland Navy of their time. But of the early days of the Dutch Navy little is known by English-speaking peoples. To bring this home to you, I beg leave to give you a short examination. I admit that perhaps a few of you have heard

of the greatest of these old Admirals, Jacob van Heemskerk. But what do you know of John Kant, Joost de Moor, Jacob Michelzoon, Van der Hagen, Matelieff or the hero of all heroes, Vice Admiral Regnier Klasszoon? As the old Dutch names have been stripped from cape, bay and island, first discovered by the hardy Dutch explorers, so have their names been omitted from the works of the English and American historian. Motley, however, in his noble volumes tells their story and it is to him that I am indebted for the greater part of my facts. I consider it a privilege and an honor to be able to bring back again the memories of these great seamen, to whom I reverently give my homage, as will you also, when you have read.

I. Wolfert Hermann in the East Indies

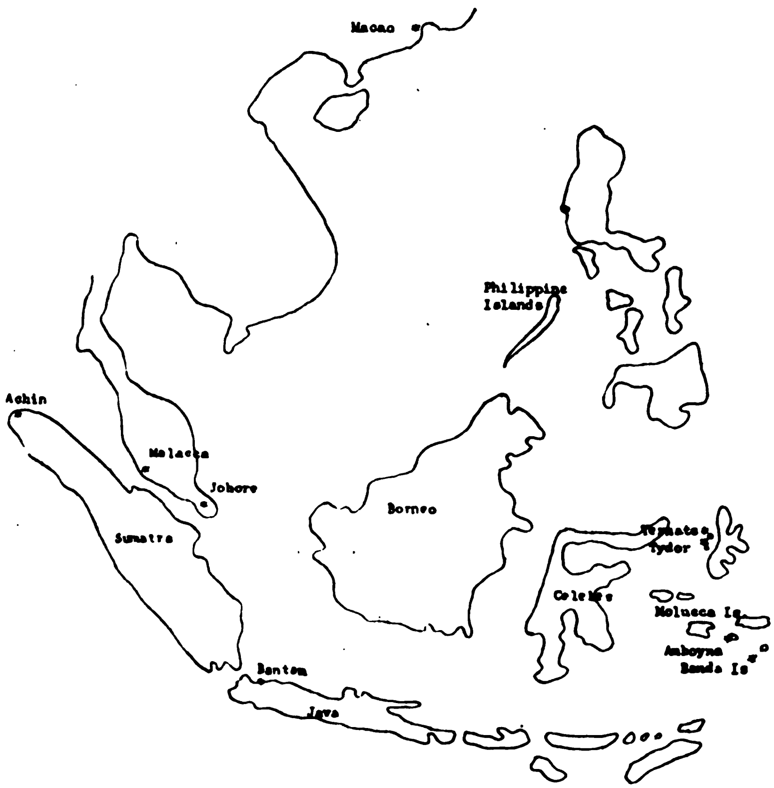
In the year 1602, a Dutch sea captain, Wolfert Hermann, arrived in the East Indies with five small merchant vessels, whose crews in all totalled about 300 men. He proceeded to the city of Bantam on the Island of Java and commenced trading with the natives.

You may remember that about a century before this a pope had divided the oceans between Spain and Portugal. The East Indies were in that portion which fell to Portugal. The merchants of all other countries were warned solemnly against trading there. But frequent warnings were not apt to prove sufficient to keep out the Netherland seaman of that time. Therefore, Admiral Mendoza set out for these waters with a grand fleet of 25 galleons and smaller vessels of war to punish the native rulers who had been trading with the Dutch merchants. This great fleet suddenly appeared off Bantam, where Wolfert Hermann was lying peacefully at anchor.

The Dutchman could probably have escaped from the slower Portuguese galleons, but this would be deserting his native friends in their hour of peril. Wolfert was not a man who would do this. Therefore, although his entire force was inferior in fighting power to the Portuguese flagship alone, he resolved to stand by his friends and offer battle to the enemy.

The Dutch merchantmen of those days—as our merchantmen to-day—were prepared to fight as well as trade, and no Dutchman ever cared for odds as far as Spaniards and Portuguese were con-

cerned. Wolfert, however, did not intend to rush wildly into action, but drew up his plans in a way which showed an excellent knowledge of naval tactics. He decided to repeat the tactics which the British had used so successfully against the Spanish Armada. The lightness and speed of his ships, the skill and seamanship of



ROUGH SKETCH OF THE EAST INDIES.

their captains, and the accurate gunnery of their crews suited perfectly a careful and deliberate engagement at long range, which, when coupled with rapid maneuvering, left Mendoza without any effective course of action for his huge floating castles. These tactics, used so long ago by the Scithian cavalry against Cyrus and Alexander and by the Parthian horsemen against the Roman Legions of Crassus, have often proved effective. They were so in this case. After almost continuous fighting for two

days the Portuguese Armada made off in disorder, having lost two ships captured, several sunk and others beached. The gallant Wolfert returned to Bantam in triumph. There he established a permanent trading station, the cornerstone of the great Dutch Empire in the East.

The Dutch squadron then proceeded to the island of Banda, where Wolfert made in the name of the Dutch Republic a treaty with the native folk there. The treaty contained the clause, remarkable considering the religious intolerance of those days, that neither nation should interfere with the religious affairs of the other but that God should judge over them all.

The next treaty was made with the king of the chief city of Sumatra who expressed a desire to send a native embassy to visit Holland. The little squadron, therefore, set out for home with the envoys on board. Off the island of St. Helena a huge Portuguese carrack was attacked and captured and her very valuable cargo divided among the Dutch crews. Finally Wolfert arrived in Holland and the Sumatran ambassadors were presented to Prince Maurice in his entrenchments before the city of Grave. Greatly astonished and pleased with what they had learned of the first modern republic in Europe, they returned to the East Indies, spreading their story throughout the islands to the great advantage of the Dutch merchants. The eventful and audacious cruise of Wolfert Hermann had laid the foundations of the Great Dutch Empire in the East, possessions which Holland retains even to-day.

II. John Kant and the Spanish Galleys

In 1600, the Spaniards began during the siege of Ostend the use of large rowing galleys off the Flanders coast. This type of craft had been used in the Mediterranean since the beginning of naval history, but had not been employed in the Atlantic for a long time. As with nearly every new type of craft they were used at first with success and even the Dutch decided to try out this new kind of war vessel.

One of the first of the Dutch galleys was built at Dort, and to test it out her captain resolved upon a most daring expedition. The galley proceeded up the Scheldt, ran past the Spanish forts and ran alongside a large Spanish galley tied up to the very

wharves of Antwerp. After a short but obstinate fight this ship was captured and in addition no less than seven smaller vessels of war. As the Spanish garrison rushed to the scene the single Dutch ship started down the river with her eight prizes while the Dutch bugler played that fine old tune: "Wilhelmus van Nassau."

In those days the wealthy Spinola family, of Genoa, provided the leaders for the Spanish forces in the low countries. One brother commanded the Spanish Army which was carrying on the famous siege of Ostend. Another, Frederic, commanded with good effect the small Spanish galleys based on Sluys. Not satisfied with this command, he obtained permission to use the eight great galleys which were building in Spain for the Spanish Navy. These huge ships were rowed by 250 galley slaves and carried 400 fighting men. In the autumn of 1602, Spinola set out from Spain with this large but unwieldy force. These ships would have an advantage over sailing ships in calm weather, but in a heavy sea would be practically at their mercy. In a light breeze the two classes of ships would fight under about equal conditions, each being able to maneuver. Off the Portuguese coast Spinola had the misfortune to run into Sir Robert Manzell with a squadron of English frigates. In the rough weather the Spaniards had little chance, and two of their ships were quickly sunk, but then the English squadron drew off to attack a Portuguese carrack which gave more opportunity for obtaining booty.

With his remaining six ships Spinola kept on for the Flanders coast. The Dutch patrolling force in the Straits of Dover then consisted of seven small war-galleots, commanded by Vice Admiral John Kant. One evening at twilight the Spanish galleys were sighted stealing along the English coast by two Dutch patrols—*Tiger,* commanded by the famous Captain Peter Mol, and *Pelican,* commanded by Captain Lubbertson. These two ships quickly sent on information to the vice admiral, who flew his flag from *Half-moon,* and was accompanied by three other galleots. The order was given to concentrate on the enemy.

At first it was dead calm and the galleys gained on the Dutch sailing ships, but later a light breeze sprang up and the galleots began to close in. Taken all together they did not carry as many fighting men as did a single enemy galley, but Dutchmen in those days cared little for odds when Spaniards were met, whether on

land or sea. Just as they were coming in range, another Dutch ship—*Mackerel*—coming from the opposite direction, ran into their midst and poured an effective volley into the galley *St. Philip*, killing 50 men. As *St. Philip* made off, the Dutch admiral in *Half-moon* came up with her and running down with all sail set, rammed her amidships. The galley's main mast and poop were carried away and as *Half-moon* drew clear she fired a tremendous raking broadside into her. To cap the climax another galleon rammed *St. Philip* and she sank with all hands.

The Dutch concentrated their efforts now on the galley *Morning Star*. A galleon, commanded by Captain Sael, commenced the attack by ramming her full speed. In the shock the bowsprit and bulwarks of the Dutch vessel were carried away, but the entire stern of *Morning Star* was destroyed and most of her galley slaves killed. Before the Spaniard could recover, Admiral Kant had rammed him again. Under this second blow the *Morning Star* sank, all her crew being lost.

The remaining galleys fled in disorder for the Flanders coast. *St. John, Hyacinth* and *Padilla* were wrecked. The flagship *St. Lewis* alone succeeded in making Dunkirk in a badly crippled condition. Over 3000 men in the Spanish squadron, soldiers, sailors and galley-slaves, were lost. The Dutch made every effort to save the lives of their enemy, but only about 200 were rescued. The Spanish Squadron had been almost completely destroyed and Spinola's plan had been ruined.

It would be impossible to praise too highly the daring and efficient work of Admiral Kant and his brave comrades. You will notice the great difference in the battle tactics of Admiral Kant and Skipper Wolfert. This very difference shows the sagacity of the Dutch seamen; in each case they considered the situation and adopted the plan of battle which best suited the occasion. Wolfert knew that it was best for him to engage carefully at long range; Kant realized that his best measure was to come to close quarters and ram, an attack very like our night destroyer attacks of to-day. In one thing, however, these old seamen were agreed. Then never considered the odds which were against them, but were eager to force a decision upon their greatly superior foe.

Let us think often of old Vice Admiral John Kant. It is true that he is very dimly discernible back across three long centuries, but we can at least keep one majestic picture in our minds. There

in the background is the long Spanish galley. In the bright moonlight we can clearly see her numerous oars lashing the water into foam. On forecastle and poop are crowds of heavily armed soldiers. Here in the foreground is the little *Half-moon*. All her sails are set. She is headed direct for her great foe. You are too far away to distinguish the individual men on her decks, but I am sure you will be able to picture in your imagination the old rugged admiral standing on his quarterdeck giving his quiet orders to the man at the wheel. Here is a man for you to remember always!

III. ADMIRAL JOOST DE MOOR OFF SLUYS

Frederic Spinola, notwithstanding the terrible beating he had received at the hands of John Kant, still had faith in the galley as a type of war vessel. With an energy worthy of a better cause he built during the winter of 1603 a new fleet of galleys in the port of Sluys. On May 25, the weather conditions were perfect for the sortie he had planned against the Dutch blockading forces. It was dead calm with a perfectly smooth sea, so that his galleys could move at high speed, while the sailing galleons of the Dutch would lie dead in the water. Spinola therefore set out with eight great galleys—each carrying 250 rowers and 200 fighting men—and four smaller vessels.

The Dutch force off the port was commanded by Admiral Joost de Moor. He could dispose of four small galleons and a vessel called the *Black Galley of Zeeland*, which was commanded by Captain Jacob Michelzoon. The whole force combined was less than one-tenth of that of the enemy, and, as only the *Black Galley* could move, it would be easy for the swift Spanish galleys to concentrate all their ships on a part of it.

The Dutch galleons lay dead in the water, but the gallant Captain Michelzoon stood on in the *Black Galley* to meet the entire squadron of the enemy. He was soon in their midst and was rammed by two of the large Spanish galleys. Their iron bowsprits ran far into the sides of the *Black Galley* and the three ships hung together. The Spaniards, being far superior in numbers, made vigorous efforts to board and a most desperate combat ensued. Captain Michelzoon was killed, but Lieutenant Hart, although himself dangerously wounded, swore to his men that he would

blow up the ship rather than surrender. Inspired by such a leader, the Zeelanders repulsed every attack of the enemy and in addition kept up a rapid fire with their guns with terrible effect. Finally the bowsprits broke off in the sides of the *Black Galley* and the three ships drifted clear for a time. The first concentrated attack of the Spaniards had been gallantly repulsed.

Meanwhile, no less than four great galleys had rammed almost simultaneously the little galleon commanded by Captain Logier. Not content with beating off the attempts of the Spaniards to board, the Dutchmen themselves boarded one of the galleys. After a hard struggle, all four galleys drew off, the Dutch boarders regaining their own ship.

Admiral Joost de Moor was next attacked, this time by three galleys. He was able to drive them off by a well-directed fire of guns and musketry before they were able to come to close quarters.

By order of Spinola a large part of his force now made a concentrated attack on the crippled *Black Galley*. Fortunately Captain Logier drifted down so close to this action that he was able to take some of the pressure off this devoted ship and attract the Spanish fire toward his own. Thus these two small Dutch ships engaged the whole Spanish squadron, while the other three Dutch vessels were forced to be spectators to this remarkable struggle. Finally Spinola, who had exposed himself with reckless courage, fell dead. A gentle breeze also sprang up, and the Spaniards, having lost their leader and suffered a terrible defeat, withdrew to the shelter of their forts. They had lost no less than 1000 men. Considering the small size of their crews, the Dutch had also lost heavily. Only three of their ships and about 200 men had been engaged. On the *Black Galley*, out of perhaps 80 men, Captain Michelzoon, 11 officers and 15 men had been killed, with an unknown number of wounded; Captain Logier was wounded and his crew suffered a loss of 15 killed and 12 wounded; Admiral de Moor was himself slightly wounded, while five of his crew were killed and 20 wounded. Of the Dutch seamen actually engaged it is certain that over half were killed or wounded.

After the pursuit had been finished the pious admiral called all hands on deck, where they knelt and recited the 34th Psalm: "I will bless the Lord at all times, His praise shall continually be

in my mouth. . . . . O magnify the Lord with me and let us exhalt His name together."

There have certainly been few actions such as this in all naval history. This beautiful picture of the old admiral and his crew in their thanksgiving for their wonderful victory is, one which should always be remembered.

IV. CAPTAIN PETER MOL AT THE STORMING OF TYDOR

I will now ask you to make another voyage to the East Indies, this time with the fleet of 13 little trading vessels which left Holland in the fall of 1603, under the command of Stephen van der Hagen. This squadron arrived in 1604, and commenced operations by establishing forts and trading stations on the island of Malabar.

In 1605, van der Hagen arrived at Amboyna, one of the chief fortresses of the Spaniards. Although it mounted 36 guns and was considered very strong, the Dutch seamen quickly took it by assault. Then the fleet broke up into several divisions for further operations.

One division under Cornelius Sebastian arrived before the citadel of Tydor in the Moluccas. This fortress was exceedingly strong and important, and was garrisoned by a large force of Spanish soldiers. Nevertheless Sebastian resolved to take it by assault.

One bright May morning, under cover of a heavy bombardment, the storming party of soldiers and sailors went forward to the assault, led by the sturdy Captain Peter Mol, whom we have seen before as captain of the *Tiger* in the first battle with Spinola's galleys.

The first attack was generally repulsed, but the Dutch leader with only seven men fought his way into the interior defenses of the citadel. Seeing their small number, the Spaniards concentrated against them and a hand to hand struggle took place. A Spanish soldier grappled with Mol and the two rolled over and over on the ground, until one of the Dutch seamen shot the Spaniard through the head. As the fight continued, Mol was severely wounded in the leg and fell to the ground, and his comrades were forced to retire, carrying with them their wounded

leader. This hero begged them to leave him, to take the fort, after which there would be sufficient time to return for him.

As this little party was retiring a projectile from a heavy gun exploded the fort's magazine. A part of the defenses were levelled and 60 men of the garrison were killed. The Dutch again moved forward and were this time completely successful.

This victory gave the Dutch East India Company the control of the Molucca Islands and the very valuable clove trade. Their successes under the vigorous leadership of Van der Hagen, Cornelius Sebastian and Peter Mol were certainly richly deserved.

V. Vice Admiral Regnier Klaaszoon

In September, 1606, the Dutch Admiral Haultain was sent to the coast of Spain with a fleet of 19 war-galleons. His vice admiral was that Leonidas of the Seas, that hero of all heroes, Regnier Klaaszoon. His name, like that of the Swiss Patriot Arnold von Winkelreid, that of the English Captain Richard Grenville, and that of the obscure French soldier who commanded the 14th of the line at the battle of Eylau, has faded from the pages of history.

On October 6, a great war fleet was made out in the distance. This proved to be the Spanish Admiral Fazardo with 18 of the largest galleons, 8 galleys and a number of smaller craft, one of the greatest forces which had been assembled for many years. The Dutch admiral was not up to the average of the Dutch admirals of those days. Had old Klaaszoon commanded-in-chief there would have been another story to tell. It is true that Haultain had now but 13 ships and that he was greatly inferior in fighting power. He, therefore, issued orders for his ships to gain a position to windward of the enemy; which done, he would give them his final orders. In attempting to carry out this maneuver the Dutch ships became widely scattered. Only Klaaszoon held on and engaged single handed the leading ships of the Spanish fleet. In a desperate fight at close quarters his main mast was shot away, but his broadsides still continued. Inspired by this wonderful example, Admiral Haultain rallied five ships and came to his rescue, and the Spanish for a time drew off. Soon, however, they came on again, and the Dutch, discouraged by their overwhelming numbers, sought safety in flight in a manner hardly

in accord with Dutch naval traditions. As the sun went down Klaaszoon's crippled galleon was seen in the very midst of the Spanish Armada, firing its broadsides with Dutch precision.

Now commenced what is without question the greatest and most remarkable fight against overwhelming odds in all naval history. It would be difficult to believe were it not given in all the Spanish and Dutch accounts of that day and specifically vouched for by the great historian Motley. For two whole days and nights Regnier Klaaszoon drifted about in the midst of the Spanish fleet. Knowing well his reputation, the Spaniards dared not board, for fear that he would blow up his ship, but they poured a continuous fire into him. The orange colors were nailed to the stump of the main mast and every demand to surrender was refused. His crew constantly returned the fire of the huge galleons until only 60 men remained alive, many of them badly wounded.

It was apparent to all that the end was at hand. The ship was sinking. It only remained to surrender or die. The Spanish admiral in recognition of his gallant defense had offered him quarter if he surrendered, a most remarkable offer from a Spanish admiral in those days.

The old admiral called his crew on deck and announced to them that he would never surrender, to which decision every man agreed. As they fell to their knees in prayer, Klaaszoon with his own hand lighted off the magazine. Two desperately wounded men were rescued by the Spaniards, but died soon after telling their dramatic story.

Thus died Vice Admiral Regnier Klaaszoon. Nothing of the dramatic was in this man; he does not agree with our usual idea of a hero; he was just a strong and solid old Dutchman who knew how to fight to the end. Regnier, we salute you! Your name will always remind us of your booming broadsides! With reverence and wet eyes we shall aways see that picture, beautiful beyond the power of mere words to paint, of the old crippled ship, the orange flag still flying at the stump of the mast, the wrecked guns, the wounded and the dead, the kneeling, praying crew and the old admiral walking, torch in hand, toward his magazine. Again we salute you and give you our earnest thanks for the happiness we have when we remember that we have lived in a world which has brought forth such men as you!

VI. JACOB VAN HEEMSKERK OFF GIBRALTAR

In order to repair the blunders of Admiral Haultain the Dutch states-general collected a fine fleet of 26 small war-galleons to employ off the Spanish coast during the year 1607.

The command of this fleet was appropriately given to the greatest Dutch seaman of that time, if not of all times, Admiral Jacob van Heemskerk. This adventurous seaman had had a most remarkable career. He had been by turns an arctic explorer, a merchant captain, the commander of a privateer and a naval officer; in all of these lines he had obtained the most astounding successes. He had commanded an arctic expedition in the attempt to discover the northwestern passage to China and had reached a position nearer the North Pole than any other man of his time. On his return his ship was caught in the icepack and destroyed. Undiscouraged by this misfortune, he led his comrades to the shore of Nova Zembla, built shelters and passed the entire winter in 77 degrees of latitude. The Dutch seamen, entirely unprepared for this rude experience and having to fight for their lives against polar bears nearly every day, suffered untold privations, but the heroic Heemskerk by his cheerful and hopeful manner sustained the courage of his comrades. In the spring the party set out in small boats. After remarkable exertions, which caused the death of several of the party, they were rescued by another Dutch vessel. Heemskerk had recently commanded two small trading ships in the East Indies. Although his crews totalled but 130 men in all, he attacked a great Portuguese carrack carrying 800 men and 17 guns. The audacious Dutchmen carried this great ship by boarding and divided among themselves 1,000,000 florins in prize money. Although quiet and gentle by nature, Heemskerk had a most intense ambition for military glory and the entire world was ringing with the daring deeds he had performed on every ocean. So great was the confidence of the states-general in this admiral that he was allowed complete discretion to carry out any enterprises which in his opinion would be of advantage to the republic.

In addition to this leader, many of the lesser officers were men of great reputations. The second in command was Laurenz Alteras, Vice Admiral of Zeeland, who was soon to prove that he was worthy of his high position. Captain Henry Janzoon, known by the familiar name of "Long Harry," and Admiral

Lambert Heinrichzoon were both well-known officers. The latter had taken part in the two fights against Frederic Spinola and had later captured in a desperate encounter the admiral of the Dunkirk pirate fleet.

On April 10, the fleet arrived off the mouth of the Tagus and spies were sent ashore to get the news. They returned with the word that a great Spanish war-fleet was cruising off Gibraltar. Heemskerk, who cared nothing for the prize money he could gain by taking treasure ships from the Indies, was overjoyed when this information was brought to him. The very fact that this armada was reported to be so superior to his fleet in guns and men increased his eagerness to bring it to action.

On April 25, the Dutch fleet sighted the Spanish Armada at anchor in the bay of Gibraltar. It consisted of 10 galleons of the first class and 11 smaller, but very formidable, war vessels. It was commanded by a veteran of the battle of Lepanto, Admiral Don Juan Alvarez d'Avila. Exclusive of seamen, over 4000 soldiers and 200 gentlemen volunteers were aboard the ships.

Admiral Heemskerk called his captains on board *Aeolus,* his flagship, and made a stirring address: " It is difficult for Netherlanders not to conquer on salt water. Our fathers have gained many a victory in distant seas, but it is for us to tear from the enemy's list of titles his arrogant appellation of monarch of the ocean. Here, on the verge of two continents, Europe is watching our deeds, while the Moors of Africa are to learn for the first time in what estimation they are to hold the Batavian Republic. Remember that you have no choice between triumph and destruction. I have led you into a position whence escape is impossible—and I ask none of you more than I am prepared to do myself—whither I am sure that you will follow. The enemy's ships are far superior to ours in bulk; but remember that their excessive size makes them difficult to handle and easier to hit, while our vessels are entirely within control. Their decks are swarming with men, and thus there will be more certainty that our shot will take effect. Remember, too, that we are all sailors, accustomed from our cradles to the ocean; while yonder Spaniards are mostly soldiers and landsmen, qualmish at the smell of bilge-water, and sickening at the roll of the waves. This day begins a long list of naval victories, which will make our fatherland forever illustrious, or lay the foundation of an honorable peace, by placing, through

our triumph, in the hands of the states-general, the power of dictating its terms."

The admiral then laid before them his plan of attack. Two ships were detailed to grapple with all of the 10 galleons. The admiral in *Aeolus* and Lambert Heinrichzoon in *Tiger* were to attack the flagship of the Spanish commander-in-chief. Vice Admiral Alteras and Captain Bras were to attack the Spanish vice admiral. Two other ships were detailed for all of the other eight. The six remaining ships, which were the smallest in the fleet, were to advance on the flanks so as to prevent the escape of any of the enemy. After the plan had been explained, the captains returned to their ships, and the fleet, led by *Aeolus* and *Tiger*, advanced to the attack. The crews knelt in prayer and passed around the loving cup, according to the Dutch custom.

When the Spanish admiral saw the little Dutch ships advancing, he had called on deck a Dutch merchant captain, who was a prisoner on board. The admiral asked him whether they were Dutch ships and if he could guess why they were coming so close. The Dutchman replied: "Either I am entirely mistaken in my countrymen or they are coming for the express purpose of offering you battle." At this d'Avila laughed and promised to take the whole enemy fleet with his flagship alone.

As *Aeolus* neared the flagship of the Spanish Admiral, *St. Augustine*, Heemskerk, like Nelson at a later day, ordered that not a shot should be fired until the vessels came together: "Wait till you hear it crack." D'Avila cut his cable in the attempt to avoid the collision, but *Aeolus* followed him through the Spanish battle line. *St. Augustine* opened fire, but with little effect. *Aeolus* crashed into her at full speed, firing her forward guns a volley of musketry. At the same time *Tiger* grappled with the Spanish flagship on the other side.

But like Nelson, the brave Heemskerk was to be struck down at the very beginning of his last and greatest victory. None can equal Motley's description of this dramatic scene, the victor dying in the hour of victory: "The *St. Augustine* fired again, straight across the center of the *Aeolus*, at a few yards' distance. A cannon-ball took off the head of a sailor, standing near Heemskerk, and carried away the admiral's leg, close to the body. He fell on deck and, knowing himself to be mortally wounded, implored the next in command on board, Captain Verhoef, to fight his ship to

the last, and to conceal his death from the rest of the fleet. Then prophesying a glorious victory for the republic, and piously commending his soul to his Maker, he soon breathed his last. A cloak was thrown over him, and the battle raged. The few who were aware that the noble Heemskerk was gone burned to avenge his death, and to obey the dying commands of their beloved chief. The rest of the Hollanders believed themselves under his directing influence, and fought as if his eyes were upon them. Thus the spirit of the departed hero still watched over and guided the battle."

Aeolus now poured her first broadside into *St. Augustine*. It killed Admiral d'Avila and caused very heavy losses on the crowded decks of the great flagship. The three ships now continued their grim struggle, yardarm to yardarm.

Meanwhile Vice Admiral Alteras was playing a fine part. As he made for the flagship of the Spanish vice admiral, *Our Lady of Vega,* two galleons attacked him. With great skill he fought them both, defeated them, pursued them to almost within range of the shore batteries and finally sank one and forced the other ashore.

But *Our Lady of Vega* was by no means being neglected. Three Dutch ships concentrated on her, set her on fire and totally destroyed her. Captain Janzoon was also busy. He attacked a large galleon and destroyed her, but was himself killed in the combat.

By this time the smoke of the guns and that from the blazing galleons had produced a scene of indescribable confusion, the ships of the two fleets being mixed in a mêlée, and hardly able to distinguish their own ships from those of the enemy. But now the Spaniards experienced a great disaster. A hot shot struck the magazine of a galleon, and the ship was blown into the air. Burning spars and sails ignited two other galleons, which likewise burned and blew up. This disaster broke the spirit of the enemy and each ship tried only to escape. The *St. Augustine* surrendered; the other ships, being unable to get to sea, due to Heemskerk's disposition of the smaller vessels on the flanks of the line for this purpose, ran ashore. The survivors attempted to gain the beach by swimming or in small boats, but the Dutch gave no quarter and massacred great numbers of the enemy in the water. Had the gallant Heemskerk lived he could probably have prevented this. As it was, the Dutch did no more than repay

the Spaniards for the most inhuman atrocities and tortures which the latter had invariably practiced. Orders signed by the king, which were found in *St. Augustine's* cabin, describing in detail how these tortures were to be carried out, did not tend to make the Dutch any kinder toward their helpless enemies.

Heemskerk's last and greatest victory was probably the most complete of all battles on a large scale in naval history. Not a ship of the enemy escaped and hardly any of the crews were saved. The Dutch lost but 100 men killed.

Perhaps you may notice a very striking resemblance between this Dutch admiral and another and more famous British seaman, Nelson. Each had had a long and varied naval career, in which remarkable successes had been won; each stood out above his fellows as the greatest naval commander of his day; each fought his last and greatest battle off the Spanish coast at nearly the same place; each desired a decision at close quarters; each concentrated a superior force upon a part of the enemy's fleet, although they accomplished this in different ways; each grappled with the hostile admiral; each received his death-blow at the beginning of the battle; each won one of the most decisive battles in naval history; each had the most intense ambition for the military glory their great deeds so richly deserved.

But Nelson lived in a time still close at hand; Heemskerk lived in the dark ages. Nelson's name is on every tongue: that of Heemskerk is known only to his own countrymen. More's the pity: the glorious life and deeds of this great admiral belong not to the Dutch alone, but to all nations. His name is worthy of remembrance by all who admire great men and daring deeds. Remember it!

VII. Admiral Matelieff's Campaign in the East Indies

In May, 1605, the Dutch East India Company sent out its third fleet. It consisted of 11 vessels of moderate size and was commanded by Matelieff de Jonghe, one of the directors of the company. The crews of the ships totalled about 1400 men.

In the summer of 1606, Admiral Matelieff—as we shall call him by courtesy, for he deserved this title if ever an admiral did—arrived in the East Indies. Although he was but a merchant skipper and his first object was to trade and not to fight, the

admiral judged that warlike exploits would be of advantage to the republic and to his company and was therefore ever willing to try his hand at them. Although such exploits were sometimes not very much to the taste of his sailors, who were to receive a share in the profits made by each ship, the admiral by his eloquent appeals was ever able to win them over to this opinion, and to inspire them with his own patriotic enthusiasm.

The first enterprise he attempted was against the Spanish town of Malacca on the Malay peninsula. This was protected by a strong stone fort, garrisoned by 3000 men, partly European and partly Indian. Matelieff induced the King of Johore, whose territory was at the extreme southeastern tip of the peninsula, to assist him in the siege with a native contingent. He then commenced a regular siege after the fashion which Prince Maurice was setting for all Europe. But, as his native auxiliaries proved useless, he was forced to give this up and to content himself with a strict investment with the object of starving out the town. After the siege had gone on for four months, the Spanish viceroy of India, Don Alphonso de Castro, arrived in the Indies with 14 great galleons, 4 galleys, and 16 smaller vessels of war. This large fleet was manned by 3700 European troops and an equal number of Indians.

The Spanish fleet first touched at Achin, on the northwestern point of Sumatra, and summoned the native king to surrender. This was the king who had sent ambassadors to Holland with Hermann. His fortifications were built after the ideas of Prince Maurice. He was assisted by a number of Dutch officers and engineers. He bravely refused the demand. Castro attacked in force, but, although one fort was taken, was decisively repulsed and forced to abandon the siege.

Hearing of the dangerous conditions at Malacca, the viceroy headed in that direction. When Matelieff's scouts informed him of the approach of the enemy, he resolutely gave up the siege, as did Bonaparte before Mantua, embarked in perfect order all his men and guns and stood out to engage the armada, which was about four times his strength.

On August 17, the two fleets fought an all-day action. Matelieff did not believe he could risk a decision at close range, and, therefore, the battle proved indecisive. Two ships were lost on each side. The Dutch saved most of the crews of the vessels lost,

only eight men being killed; while the Spaniards lost a far greater number. As night came on Castro anchored off Malacca, while the Dutch commander retired to Johore. Thus, while the action might be called a tactical victory for the Dutch, because they had inflicted the greater damage on a four-fold superior force, it was a strategical victory for the Spaniards, because they had succeeded in relieving Malacca.

This partial setback disturbed Matelieff very little, for he lay quietly at Johore repairing his damages and waiting for a chance to even up matters. He soon heard that a part of the Spanish fleet had left and at once decided to attack the force which remained. On September 21, the Dutch force of nine ships left Johore and in the afternoon sighted the Spanish squadron off Malacca. Seven galleons and three galleys were anchored in a semicircle in front of the town.

The Dutch commander concentrated his force and attacked with vigor the center of the Spanish formation. The center galleon was attacked by three Dutch ships, boarded and captured after a sharp fight of an hour's duration. A second was burned to the water's edge, while a third surrendered. Before Matelieff could extend his success, night came on and the battle came to a close. In the morning the Dutch returned and took possession of a fourth galleon, which was found deserted. The remainder of the Spanish squadron had succeeded, however, in running in under the guns of the fortress, where Matelieff did not dare to follow on account of the shoals. Another attack was not necessary, for the Spaniards in their panic burned their ships and retired into the fort. The Dutch had thus caused the loss of 10 fine men-of-war at the cost of only a few men. The admiral removed 24 of the Spanish guns, burned his prizes and exchanged prisoners at the rate of 20 Spaniards for one Dutchman, thus showing in an amusing way his idea as to their comparative values.

Having thus placed affairs on a sound footing in the western part of the Indies, Matelieff proceeded to Bantam, at the western end of Java. From here he sent home three richly loaded ships. With the remaining six vessels he sailed for the Moluccas, touching first at Amboyna, where he strengthened the fortifications. Having heard that a large Spanish fleet coming from the Philippines had captured the island of Ternate and carried off the sultan

a prisoner, he hurried in this direction. On the south side of the island the enemy had built a strong fort, manned by a large garrison. Judging that it was inadvisable to attempt to reduce this, he himself built a fort on the north side and established the son of the captured sultan there. He was given an army of 45 Dutch sailors and a navy of four tiny yachts. "Such were the slender means with which oriental empires were founded in those days by the stout-hearted adventurers of the little Batavian Republic."

Sending three more ships home, the enterprising Matelieff sailed with three ships for China. Here, through no fault of his own, he was unable to carry out any commercial operations, and so headed again for the southward. As he was passing the port of Macao, six large Portuguese galleons stood out for him. Much as the brave Dutchman wished to engage them, he, after careful consideration, decided that he could not risk an engagement. He had but three ships against six, and even they were sadly in need of repair. His powder was nearly gone. He realized what a bad effect it would have on the Chinese if the Dutch were defeated in their first fight in these waters, and prudently avoided the Portuguese by his clever seamanship.

Touching again at Ternate, he learned that his little garrison there had repulsed a strong Spanish attack. Proceeding to Johore, he gave assistance to the native king, who in a panic had burned his capital and fled into the jungle. Then, after having been relieved by Paul van Kaarden, with eight war-galleons, he proceeded home. He had the honor to read a report of his campaign to the states-general, which met with their very warm approval.

This Dutch merchant skipper, for he was nothing more, had more than held his own against the far superior Spanish and Portuguese naval forces in a long and varied campaign 12,000 miles from home. It is true that he had not performed the striking exploits of Kant or Heemskerk. He had won only one remarkable success, and that was partly due to the weakness of the enemy. But, having, regard for the fact that successful commercial operations were as much, if not more, his mission as were military and naval victories, I believe that his entire campaign was a very fine one, conceived with sound judgment and executed with vigor and resolution.

Conclusion

And now I have come to the end of these little stories of the old Dutch heroes. Pericles said that he did not approve of the Athenian custom of having an oration made at the funeral of the soldiers who had fallen in battle, because he feared that a poor oration might lessen the fame of their brave deeds. It is with somewhat the same feeling that I offer to you these little stories. But I feel certain that these old heroes will worry no more about what some one may write about them three centuries after they passed from the world's stage than did old Regnier Klaaszoon about the 18 Spanish galleons. I hope, too, that I may add somewhat to the fame of these oldtime seamen of the Dutch Navy, whose deeds have been so cruelly neglected. If I can pay off the debt which the whole civilized world owes to these first warriors in the cause of freedom and democracy, if anybody in any way can do this, then I will be very happy, because I feel that workers in this sacred cause should reverently give homage to these old naval heroes, its first champions.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A "WRINKLE" TO SAVE TIME IN NAVIGATION

By Commander F. D. Pryor, U. S. Navy

When one must work in a sweat box, such as a chart house becomes when the ship is darkened, any method that shortens the work at that time is most welcome. Though there is nothing startling in the following process, it is something that no navigator I have met has used, and one of which none of the younger officers I have come in contact with have ever heard. Therefore, having never seen anything in print along these lines and having found the process reliable and a great help, I pass it along for what it may be worth to others.

The process is simply to combine, before sunset, all the elements of the work of the haversine formula possible, leaving very little to do after star sights are taken.

To begin with, one determines the time of sunset and from that time *assumes* the "middle time" of the series of times of the various sights. For example, if the sunset is at 6.30, and the navigator knows from experience that it will be dark at 7.15, and that he will get his first star about 15 minutes after sunset, he can safely assume 7 p. m. as the "middle time" of his sights.

One then determines the D. R. position from which to work and obtains C—W.

The "middle time" of sights is converted into G. M. T., and the R. A. M. S. taken out of the almanac and corrected for this Greenwich interval, giving the correct R. A. M. S. for the "middle time."

This R. A. M. S., the C—W, C. C. and the longitude (expressed in time) are then all combined, being careful to observe the algebraic signs. (C. C. may be plus or minus, longitude will always be minus when west, and plus when east.) The result is a "constant" to be used in all the sights. The watch time of sight plus the "constant" gives the L. S. T. at once.

Besides the "constant" it is possible to do much else to shorten the time in the sealed up chart house.

One decides what stars he will observe and the declinations and right ascensions of these stars are taken out and entered in the forms. The cosines of the latitude and the various declinations are taken out entered in the forms and added up and the sum entered in the sight form, L—D is determined and the nat hav of this taken out and put down in the form.

Having done this preliminary work, when the stars are observed the following only remains to be done: (1) Correct the observed altitude; (2) add the "constant" to watch time of sight; (3) combine the L. S. T. thus obtained with the R. A. and obtain t. The log hav of t is added to the previously combined logs of L and D (the addition of two numbers is simpler and therefore faster than three), and the nat hav taken out and added to the nat hav of L—D.

Below is an example showing the saving it is possible to obtain in a sight:

SHORT METHOD

(All work that can be done in p. m. is entered in ordinary type; evening work in black face type.)

P. M. STAR LINE, 19 May, 1918. STAR, Arcturus.
D. R. Position—Lat. 10 42 00 N.
Long. 20 27 00 W.
$1^h\ 21^m\ 48^s$

W	6 45 00			Obs. h 34 44 30
C—W				Corr. (—) 6 30
				True h 34 38 00
C. C. ( )		Middle time	6 40 00	
G. M. T.		Corr.=(C—W+C. C.)	1 15 26	Z 74° true by Weir diagram of course
		G. M. T.	7 55 26	
Long. ( )		R. A. M. S.	3 45 23	C—W, C. C. (+) 1 15 26
L. M. T.		Corr.	+ 1 18	
R. A. M. S.		R. A. M. S.	3 46 41	λ W. (—) 1 21 48
		Corr. (—)	0 06 22 ←	Corr. (—) 0 06 22
* Corr.	3 40 19	Const.	3 40 19 —	This is the constant used in all sights.
L. S. T,	10 25 19			
*R. A. ( )	14 11 58			
t	3 46 39	log hav	9.35260	
L	10 42 00 N.	log cos	19.96644	9.99238
d	19 36 18 N.	log cos		9.97406
		log hav	9.31904	19.96644
		nat hav	.20847	
L—d	8 54 18	nat hav	.00603	
z	55 10 50	nat	.21450	
h (comp.)	34 49 10			
h (obs.)	34 38 00			
	11 10 away.			

* These may also be combined in p. m. if desired.

LONG METHOD

P. M. Star Line, 19 May, 1918. Star, Arcturus.
D. R. Position—Lat. 10 42 00 N.
Long. 20 27 00 W.
1 21 48

W	6 45 00		
C—W	1 04 32		
C. C. (+)	10 54		
G. M. T.	7 59 86		
Long. (—)	1 21 48		
L. M. T.	6 38 38		
R. A. M. S.	3 45 23		
Corr.	1 19		
L. S. T.	10 25 20		
R. A. ( )	14 11 58		
(—) t	3 46 48	log hav	9.35254
L	10 42 00 N.	log cos	9.99238
d	19 36 18 N.	log cos	9.97406
		log hav	9.31898
		nat hav	.20844
L—d	8 54 18	nat hav	.00603
z	55 10 35	nat	.21447
h (comp.)	34 49 25		
h (obs.)	34 38 00		
	11 25 away.		

Obs.	h	34 44 30
Corr. (—)		6 30
True	h	34 38 00

Weir Z 74° true

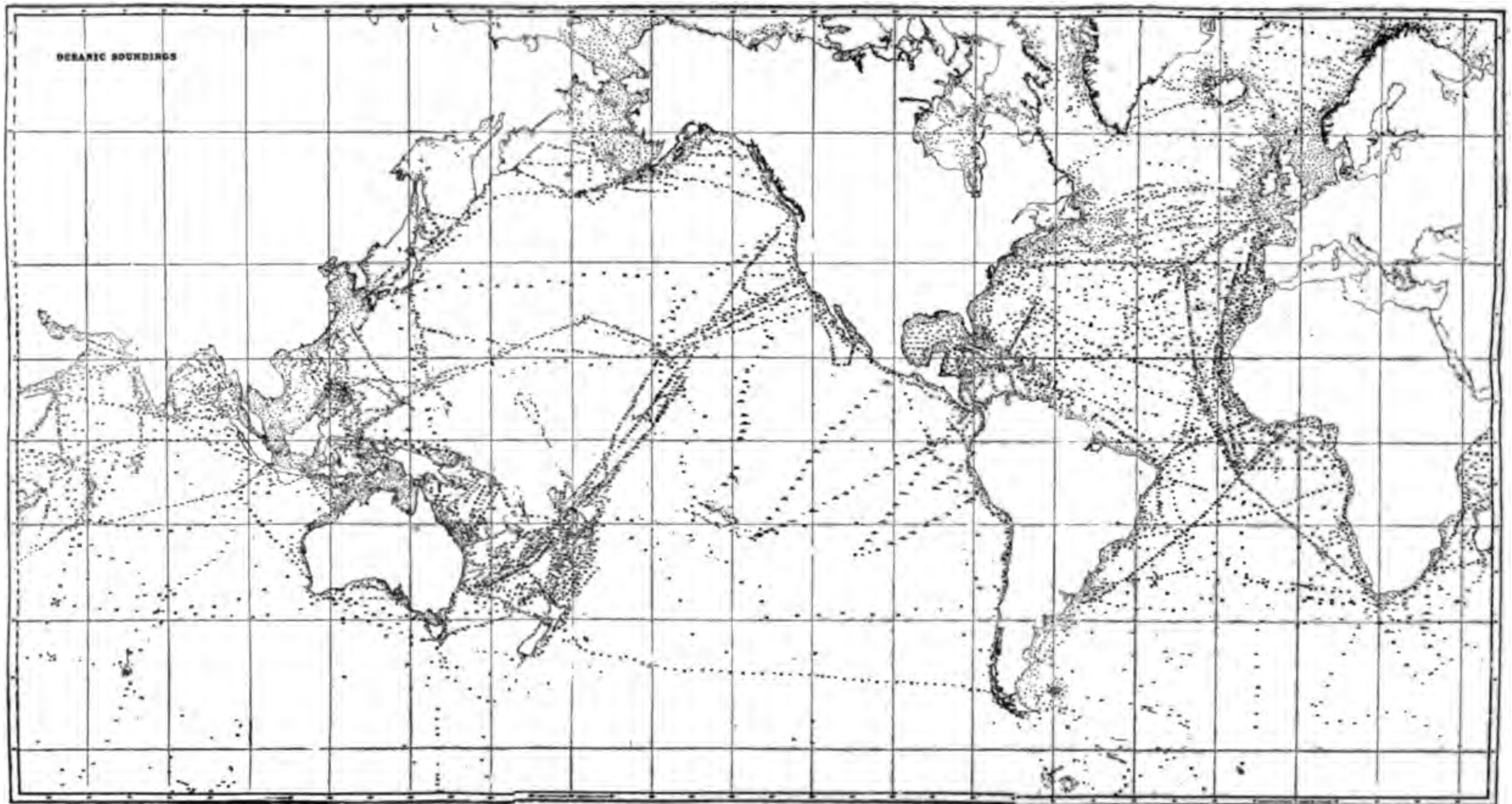


CHART OF OCEAN SOUNDINGS

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE PHYSICAL CHARACTERISTICS OF THE OCEAN DEPTHS

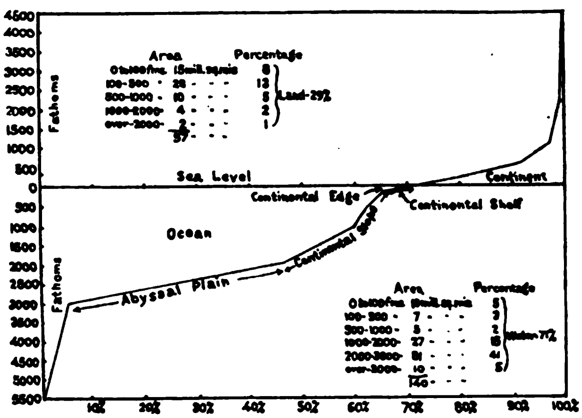
By G. W. LITTLEHALES

As a result of the marine hydrographic coast surveys of the various maritime countries, undertaken in the interests of navigation, the coast line of the world is now among its best known geographical features, and hence, since geodesists have determined the size of the terrestrial spheroid, the area of the oceanic surface of the globe is known with closeness to be 140 million square statute miles, which is an expanse exceeding the total area of the lands of the globe by 83 million square statute miles. In other words, 71 per cent of the surface of the globe is covered by the waters of the ocean. Although the depth of the ocean has been measured in many thousand places throughout the world, since the middle of the nineteenth century when deep-sea soundings first began to be successfully made, yet, as will be seen from the accompanying world-chart showing where the ocean has been sounded, there are oceanic areas as large as the United States where no soundings have been taken, and many others where the present soundings are but widely spaced. The contours of the oceanic basins cannot, therefore, be completely drawn at present, and the volume of the ocean may only be stated by estimation to be 324 million cubic statute miles, or 14 times the bulk of all the lands in the world above sea level. The accepted measurements of the areas within the different zones of depth are shown in the diagram on page 46.

The mean depth of the ocean is estimated to be 2080 fathoms; and the greatest depth, which is found east of the Island of Mindanao, is 5348 fathoms.

In their general extent and position, it is likely that ocean basins have been permanent since the waters were gathered together. The study of deep-sea observations does not support the view that, by alternate rising and sinking of the earth's crust, oceans and continents have successively occupied the same areas.

All known chemical elements have been found in the waters of the ocean, and if there are any that are unknown, they will also be found there. Although the total amount of salts contained in sea water varies in different parts of the ocean, the existing proportions set forth in the following table, according to Dittmar's



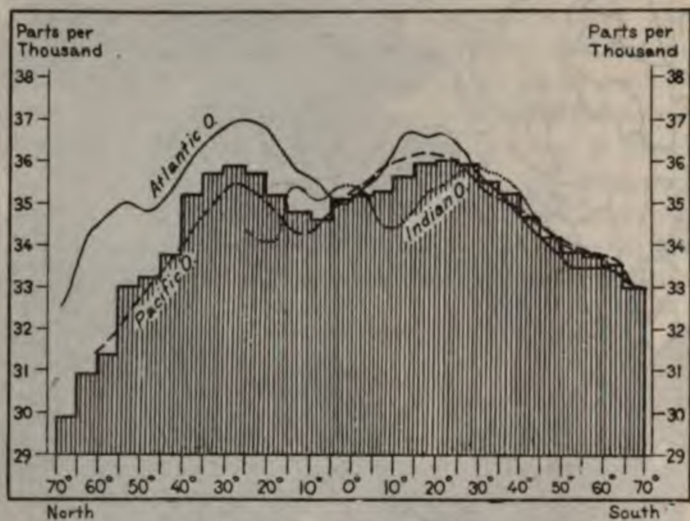
DIAGRAMMATIC SECTION SHOWING THE AVERAGE CONTOUR OF THE LITHOSPHERE, BASED UPON THE PERCENTAGES OF THE AREAS BETWEEN THE CONTOUR-LINES ABOVE AND BELOW SEA-LEVEL.

analysis, are practically the same in all parts and at all depths of the open ocean:

Sodium chloride	27.213	parts	per	thousand.
Magnesium chloride	3.807	"	"	"
Magnesium sulphate	1.658	"	"	"
Calcium sulphate	1.260	"	"	"
Potassium sulphate	0.863	"	"	"
Calcium carbonate	0.123	"	"	"
Magnesium bromide	0.076	"	"	"

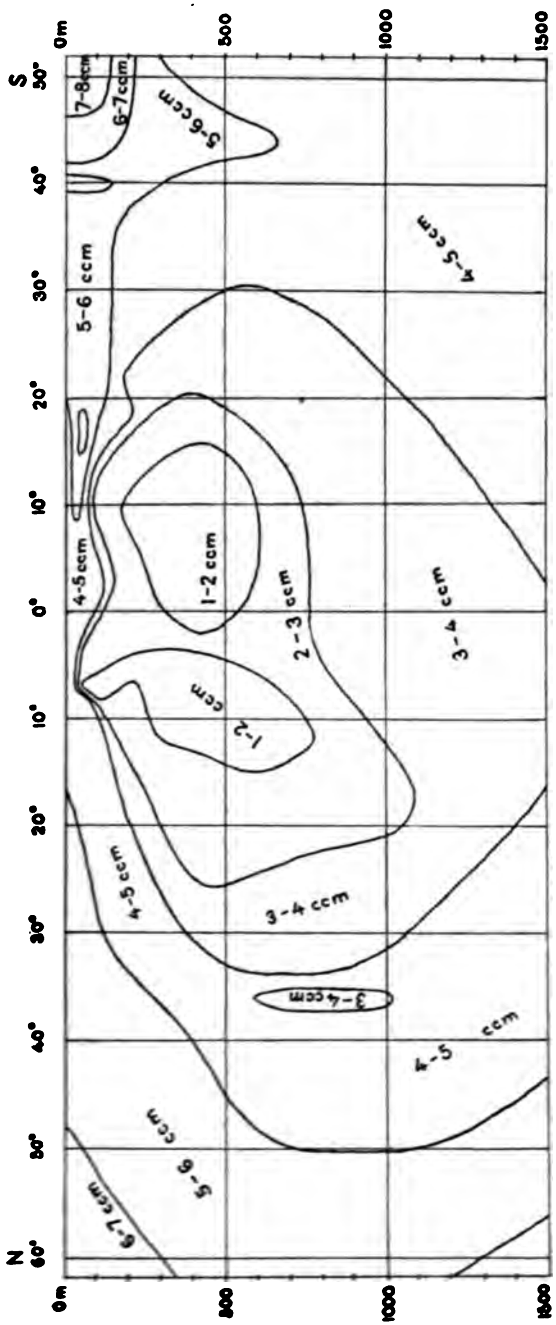
The dissolved substances are present mainly as ions. Of the elements in solution, sodium and chlorine seem to be the only ones that are not withdrawn by organisms and organic processes,

DEPTHS OF THE SEA.

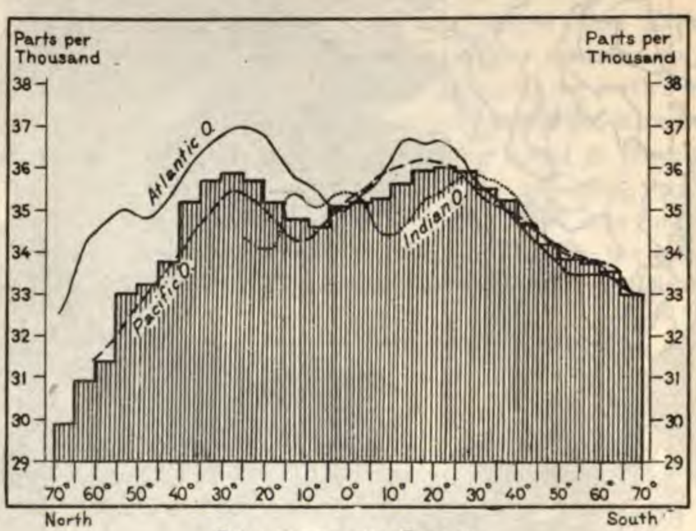


SALINITY OF THE OCEANS.

SALINITY OF THE SURFACE OF THE OCEAN.



THE DISTRIBUTION OF OXYGEN IN THE ATLANTIC OCEAN BETWEEN 60°N AND 50°S.



SALINITY OF THE OCEANS.

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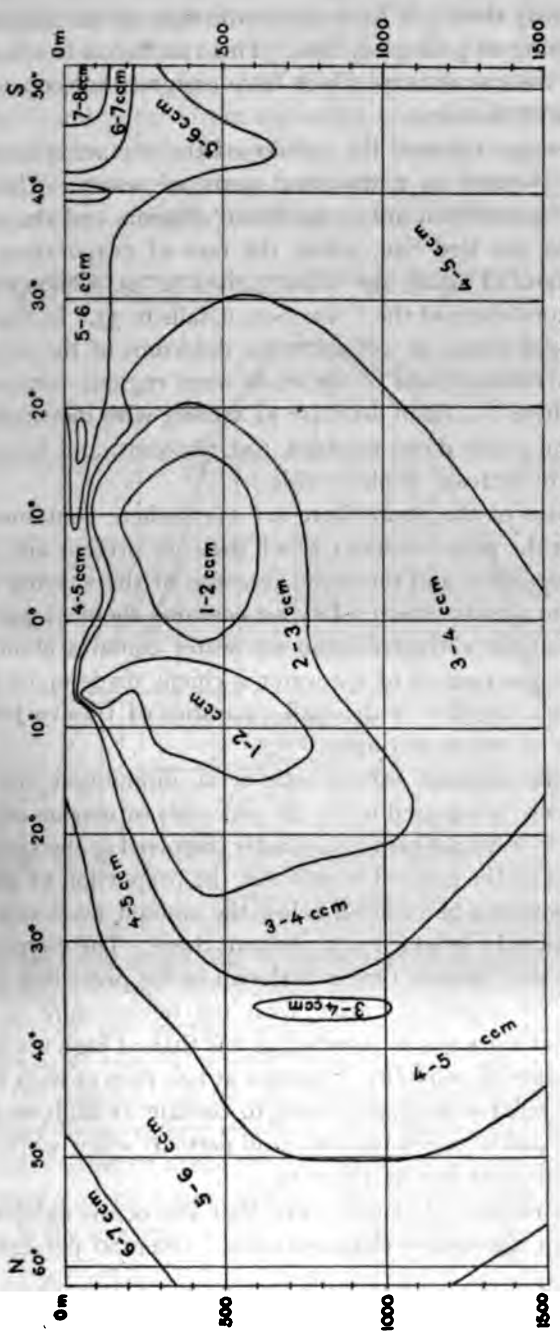


THE DISTRIBUTION OF OXYGEN IN THE ATLANTIC OCEAN BETWEEN 60°N AND 50°S.

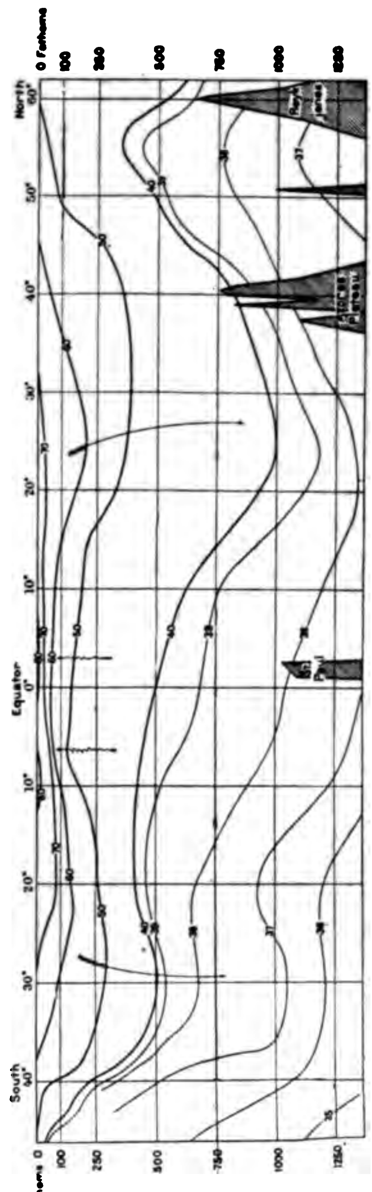
The following table gives the mean temperatures for the whole ocean, as calculated from all observations in all latitudes at the specified depths:

Depth in fathoms	Mean Fahrenheit temperature
100	60.7°
200	50.1
300	44.7
400	41.8
500	40.1
600	39.0
700	38.1
800	37.3
900	36.8
1000	36.5
1100	36.1
1200	35.8
1300	35.6
1400	35.4
1500	35.3
2200	35.2

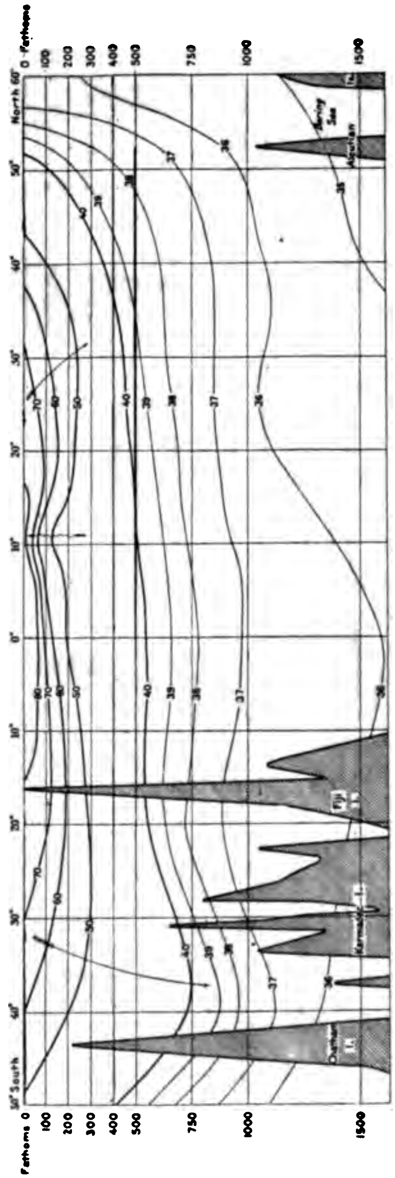
While the mean daily variation of temperature in the surface waters of the open ocean is probably less than 1° F., the range from season to season may amount to 50° F. in those regions, like the oceanic areas around Japan, Newfoundland, and the Cape of Good Hope, where the surface is occupied successively by waters of polar and of equatorial origin; but, on the other hand, there are very extensive regions both in the tropical and polar waters where the range does not exceed a few degrees during the course of the year. With descent into the depths, the seasonal changes in temperature tend rapidly to diminish.

The variation of the density of sea water according to salinity and temperature is a prime factor in oceanic circulation. The average geographical distribution of density of the surface waters is shown in the accompanying chart, while the mean density at successive depths is given in the following table:

Depth in fathoms	Density
Surface	1.0252
100	1.0261
200	1.0268
300	1.0271
400	1.0273
800	1.0276
1500	1.0279
2000	1.0280

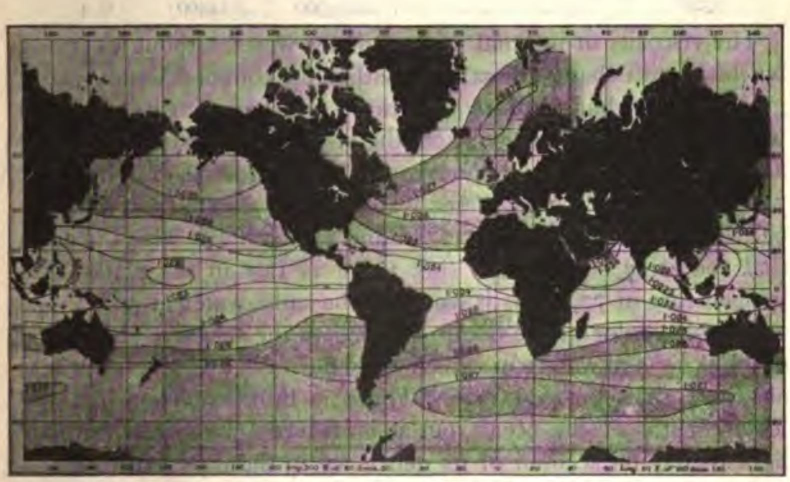


TEMPERATURE PROFILE OF THE ATLANTIC OCEAN ALONG THE MERIDIAN OF 30° W.



TEMPERATURE PROFILE OF THE PACIFIC OCEAN ALONG THE 180TH MERIDIAN.

ANNUAL RANGE OF SURFACE TEMPERATURE.



DENSITY OF THE SURFACE OF THE OCEAN.

The observed increase of density with increasing depth is chiefly attributable, down to 1000 fathoms, to decrease of temperature, but below that depth the continued rise in density is due to a small increase of salinity which prevails in the greater depths of the ocean, augmented by the compression to which the deep waters are subject under the weight of the superincumbent mass, since water is compressible by about $\frac{1}{20000}$ of its bulk under the pressure of one atmosphere. Leaving out of account the pressure of the atmosphere upon the surface, the pressure at successive depths in the ocean is as follows:

Depth	Pressure per square inch: Atmosphere	Pounds	Tons
33 feet	1	15	...
66 "	2	30	...
99 "	3	45	...
100 fathoms	18	270	...
500 "	90	1350	...
1000 "	180	2700	1.2
2000 "	360	5400	2.4
3000 "	540	8100	3.6
4000 "	720	10800	4.8
5000 "	900	13500	6.0
5348 "	960	14400	6.4

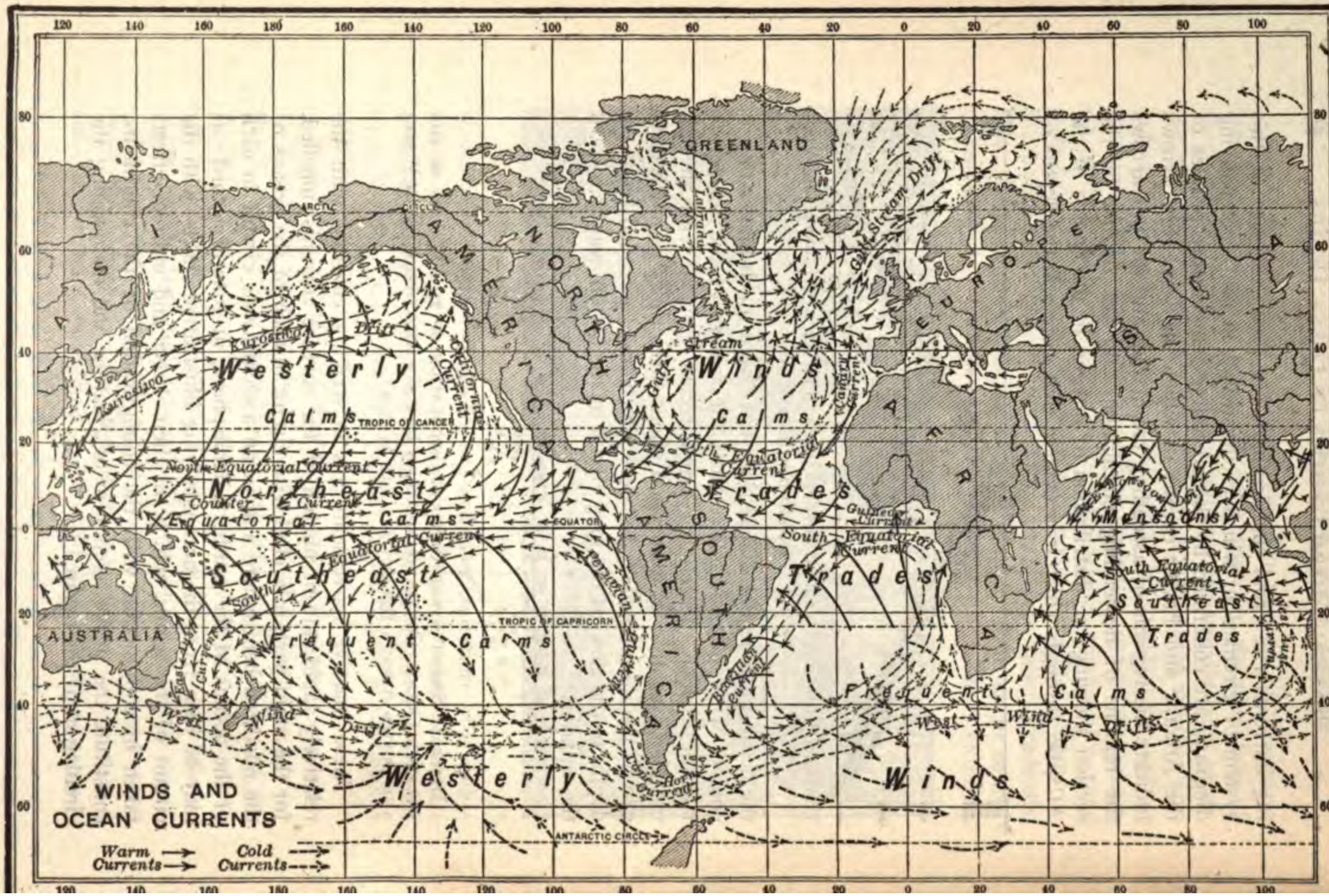
The viscosity or internal friction of sea water, although varying but little with change of salinity within the common limits, varies greatly with change of temperature. If the viscosity of fresh water at 32° F. be stated as 100, the viscosity of sea water having a salinity of 30 parts per thousand will be 102 at 32° F. and 52 at 77° F., and the viscosity of sea water having a salinity of 35 parts per thousand will be 103 at 32° F. and 53 at 77° F. This indicates that the same body would sink twice as fast in sea water at a temperature of 77° F. as it would in the same water at 32° F.

The blue color of the ocean is owing to the selective absorption of light by sea water, in which the blue rays are ten times less absorbed than the red rays. There is light entering into the lesser depths of the ocean, but it is different from the familiar light of day on account of its deficiency in the rays from the red end of the solar spectrum. Recent observations conducted with photographic plates showed that, on a sunny day in the Sargasso Sea, there was sufficient light at a depth of 550 fathoms to affect a sensitive film after an exposure of 80 minutes. Another plate was exposed for 2 hours at a depth of 900 fathoms without show-

ing any effect. By employing filters for rays of different color, it was shown that, at a depth of 275 fathoms, many blue rays were present but scarcely any red ones, while at a depth of 55 fathoms all the component rays of sunlight were present, although there were fewer of the red than the others. The extent of the vegetable kingdom in the ocean is confined to this region of light-penetration or photic zone which must vary in its depth according to the zenith distance of the luminary and the nature of the materials held in suspension and solution in the water. The living matter which covers the globe wherever water, air, and earth commingle, while extending only a short depth into the crust of the earth and a short height into the atmosphere, extends throughout the whole depth of the ocean; but below the photic zone all of the numerous forms of living things which abound belong to the animal kingdom.

The deposits which cover the bed of the ocean have been classified by Murray, according to their origin, into two grand divisions—terrigenous and pelagic. In the accompanying table these deposits are described and further subdivided into classes, and the distribution of the principal ones are shown in the subjoined map:

Littoral Deposits between high and low water marks.	Boulders, shingle, gravels, sands, muds, etc., derived from adjacent land.	*Terrigenous Deposits* formed in deep and shallow water close to land masses, from materials carried down from the land surfaces or torn away from the coast together with the remains of organisms which live on the bottom in shallow waters.
Shallow-water Deposits, between low water mark and 100 fathoms.	Sands, gravels, muds, marls, derived from adjacent land, shores, and shallow waters.	
Deep-Sea Deposits beyond 100 fathoms.	Blue mud, Red mud, Green mud, Volcanic mud, Coral mud,	
	Globigerina ooze, Pteroped ooze, Diatom ooze, Radiolarian ooze, Red clay.	*Pelagic Deposits* formed in deep water far removed from land, largely from the remains of calcareous and siliceous organisms which have lived in the surface waters and have fallen to the bottom after death.



WINDS AND
OCEAN CURRENTS
Warm Currents
Cold Currents
GREENLAND
ASIA
EUROPE
AFRICA
NORTH AMERICA
SOUTH AMERICA
AUSTRALIA
TROPIC OF CANCER
EQUATOR
TROPIC OF CAPRICORN
ANTARCTIC CIRCLE
Westerly Winds
Calms
Northeast Trades
Southeast Trades
Frequent Calms
West Wind Drift
Monsoons
California Current
Labrador Current
Gulf Stream
Gulf Stream Drift
Canary Current
Guinea Current
North Equatorial Current
South Equatorial Current
Counter Current
Equatorial Counter Current
Peruvian Current
Brazilian Current
Kuroshio
Kuroshio Drift
East Australian Current
West Australian Current
Cape Horn Current

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

RECKLESS READINGS OF A NAVAL OFFICER

By CAPTAIN DAVID POTTER, Pay Corps, U. S. Navy

If to enjoy literature it is necessary to be master of *critiques*, then we are without privilege to speak of it. If real *belles lettres* are the only sort worthy of reminiscence, then read no farther here! If one who has not so much brooded with Melpomene as he has laughed with Thalia must be denied acquaintance with the Muses, then our claim to their friendship is small. As a naval officer we are one of a circle where things are more often done than they are read about—military men suffer from lack of exercise of their imaginative faculties. Nevertheless, some sort of bookishness must be conceded to us.

* * *

Since the story of Dick Whittington and his cat, in words of one syllable, hardly can be counted, "*The Lady of the Lake*" was the first bit of literature to be impressed upon our mind.

When the smallest of kilted boys we had the happiness to possess a bachelor uncle—the only man among the ten thousand inhabitants of the town bold enough to allow himself to be entered in the directory as "gentleman-of-leisure." He toiled not and neither did he spin; unless it be counted toil to work for the pleasure of others, or reckoned spinning to weave rainbows of fairy tales and verse for our gaping and adoring selves.

In a wilderness of a garden there was a cottage, and in that cottage there was a "den," and in that "den" there was a rush-bottomed chair with sawed-off legs. Installing us in the chair before him, the bachelor uncle would play: "Oh, Are You Sleepin', Maggie," or "Whistle, And I'll Come To You, My Lad," on his fiddle—the word "violin" was anathema to him. And

his fiddling he would accompany by the sweetest whistling we have ever heard except from a song-thrush's bill.

We can understand now that such orchestration must have been by way of sly prelude for what was to follow—his own laughter, perhaps only half humorous, that a grown man should find nothing better to do than to amuse a child.

After the music, old green-bound volume in hand, although he knew whole cantos by heart, he would begin sonorously:

"The stag at eve had drunk his fill
Where danced the moon on Monan's rill,
And deep his midnight lair had made
In cool Glenartney's hazel shade.
But ere the sun his beacon red
Had kindled on Ben Voirlich's head,
The deep-mouthed bloodhound's heavy bay
Resounded up the rocky way. . . ."

That moon, and that sun, and the twinkle in the bachelor uncle's blue eyes, all dance together in our heart.

* * *

At the school we attended, the masters were all British, counting one Nova Scotian as such. The headmaster, as it happened, was both a Cambrian and a Cantabrigian. By right of his native mountains he had a profound knowledge of the Bible, particularly of the Old Testament; and by right of his alma mater he had a very notable skill as a scansionist of the Roman poets. He could scan Virgil at sight—ability, we are informed, very rare even among Latin scholars. It was he who first put music for us, as well as meaning, into Dido's lament for the faithless Aeneas.

But our memory lingers more on the Scriptural side of the headmaster's talents. Every week he gave a lecture to the school on the Bible. Into this lecture no matter of religion, much less of dogma and doctrine, was allowed to enter, but only the literary and historical character of the great book.

Much of the New Testament and a little of the Old we had learned from others—the headmaster illumined for us *Joshua* and *Judges* and the *Kings* and the *Samuels,* and *Isaiah* and *Ruth* and *Job.*

The suggestion of mystery and infinite horror in the account of the Danites' terrible visit to Laish chilled our young marrow as we heard it:

"They came unto Laish, unto a people that were at quiet and secure: and they smote them with the edge of the sword, and burnt the city with fire. And there was no deliverer, because it was far from Zidon, and they had no business with any man."

The words "at quiet and secure" have a sinister significance for us to this day.

The story of the wise ladies of the mother of Sisera, who answered her as she cried through the lattice, put strange fancies in our head: "to every man a damsel or two." The essential spirit of the spoiler was in that cry—the same that fired the German lanzknechts in the sacking of Rome, that swept with it Tilly's devils at Magdeburg, that, more recently, whirled on with the same Teutonic fiends into Belgium.

* * *

Alfred Tennyson! A name not to conjure a male with between the ages of 20 and 60!—so far at least as his lyrics are concerned—but very powerful outside those ages.

It was a melody in "*The Foresters*," which we chanced to see very charmingly acted, that awakened our interest in Tennyson's poetry.

"There is no land like England
  Where'er the light of day be;
There are no maids like the English maids,
  So beautiful as they be.
And these shall wed with freemen,
  And all their sons be free,
To sing the songs of England
  Beneath the greenwood tree."

There was a time—we affirm it with little of exaggeration—when we had half of Tennyson's lyrics at our tongue's end, and a great deal of his epical romances as well.

How we gloried in the plump headwaiter at the *Cock* to which we most resort! And the bitter barmaid, waning fast, was ordered to see that sheets were on our bed so often and so loudly that once the head of the household was compelled to remind us in ominous tones that every moment dies a man!

In those green-sickness days, how we used to invite the queen rose of the rosebud garden of girls to come into the garden where the black bat, Night, had flown! And how we hated with a real hatred the dreadful hollow behind the little wood! We fled with "*Edwin Morris*" when "there came a mystic token from the king." With him we despaired when

> "They wedded her to sixty thousand pounds,
> To lands in Kent and messuages in York,
> And slight Sir Randolph with his watery smile
> And educated whisker."

Do we undervalue Tennyson now? Perhaps. We do not forget "*In Memoriam*" or the "*Idylls,*" or "*Ulysses*"; but we believe that to do one's right work in the world one's heart must have some alloy of hot metal, and Tennyson's poetry never put hot metal into any man's heart. Even "*Ulysses*" expresses only the resolution of broken men—there is iron there but the iron is cold.

* * *

The *Nibelungenlied* fell to us in college days. In the library of the old university, perched upon a ladder in the upper tier of the northern alcove, with Siegfried we seized Brunhilde and chastely stretched the sword between ourselves and her. The bookshelves about us were the great oaks of the Thuringian forests; and the meek heads of the librarians, seen through the grated floor of the tier, were those of the stark heroes of the epic, holding their God-doomed ways.

Here, too, Monsieur Guizot, in a dozen easy volumes, enamoured us of France. The history of that lovely land and its incomparable people—its sluggard kings, its Charleses, the Hammer and the Great, its Louis, the Good and the Bad and the Bald and the Fat and the Well-beloved—stirred us greatly. Its Jacquerie, its Armagnacs, its Leaguers, its Frondeurs, its Sans-culottes, its Vendeans, swam before us in a red mist. Between and over all, Agnes, Gabrielle, Diane, La Vallière, and all its other fair and pitiful ladies, made us wish that we too might have sighed at their feet.

In that same alcove of the old university library we re-read "*Prince Otto,*" and read for the first time, "*Will of the Mill*" and "*The Master of Ballantrae.*" To this day dreadful Otto is

dearer to us than dreamful Will, and the cool depths of Grünewald are more alluring than the shaggy Champlain fastnesses where the devilish Master played his last trick.

* * *

During college days, a classmate and ourselves went for a stroll along the berm of the canal that dawdled behind the old town. The day was hot, and we sat down to rest under an elm. Each pulled out a book. Ours was frankly Kipling—at that time he was always ready in the pocket of our coat as Shakespeare was in the pocket of our pajamas! But over the top of "*The Seven Seas*" our eyes fell on the plain brown book in our classmate's hand.

"What are you reading?"

"Essays—Emerson's."

"Emerson? I've never read him."

"Then you've lost 20 years of your sweet young life. Listen!"

For two hours we listened—with a sense of moving through a rarefied atmosphere vaguely unsatisfying to sturdy lungs—with a sense of hearing the frosty crackling of infinitely-delicate ice. We have since learned to know Emerson's writings better, to love them not at all but to feel their inspiration. It was not until we had seen men die violent deaths that Emerson's "*Brahma*" became significant to us:

> If the red slayer think he slays,
> Or if the slain think he is slain,
> They know not well the subtle ways
> I keep, and pass, and turn again.

It was in college, also, that John Fiske's "*Idea of God*" came to the rescue of a mind groping in the void, and helped to establish beliefs that bid fair to last through life. Whether or not such beliefs are those the book really sought to give just expression to we are not at all sure. At any rate, the meaning and purpose of life have been the clearer since Fiske's books were read.

* * *

In these piping times of war some of our torpedo-boat destroyers often cuddle close to the flanks of old Ireland. No doubt, in consequence, many an officer has drawn new sustenance from Charles Lever's "*O'Malley, the Irish Dragoon*" and from "*Tom Burke of Ours.*" But perhaps not so many have read the tales of

John Banim and Michael Banim, those super-Levers. Long before men-of-war were more than a name to us, we accompanied the Banims from "*The Bit-o-Writin'*" to "*The Boyne Water.*" With the Banims, we waked the dead, kissed the colleen, cursed the bad young squire, cherished the good old one, and married mavourneen at last in the thatched shebeen on the wild coast of dear Donegal.

Before we had become one of the adventurers who have traveled east of Suez, we felt that we knew Golden Goa, very busy with small trade, and Macao—until lately reputed iniquitous and opium-damned—both cities beloved of the Portuguese. These seats of ancient splendor, and the Kingdom of Pegu in Burmah, we had traversed from end to end in the "*Memoirs of Mendez Pinto*" before ever we actually saw them with corporeal eyes. It was more than three hundred years ago that Pinto and his rabblement of rakehells fought Mogul kings and Christian governors, made and were made slaves, plundered estates in the Japan that they were first of Europeans to see. More than three hundred years ago, too, they quietly went a-fishing—amazing diversion for such bloody-minded folk!—"at a river of sweet water, full of very fine trouts, hard by a little pagoda."

* * *

The war with Spain, and the Philippine Campaign that followed hard after, made it our duty to live adventures of the sort we had hitherto only read about.

At Cagayan de Mindanao in the Philippines, the enemy gave way before the forces of the navy and the army. With a sufficient squad of bayonets to support us, we broke over a parapet, sword in hand. A colonel of Filipinos fled before us down a little street. We followed in hot pursuit.

At the corner of the street, doubling, he avoided us by a hair. At the gateway of a courtyard we were only a yard behind him. Up the stairway of the Cuartel our swordpoint was at his very vertebra. Across a hall we sped, but our thrust, delivered at last, impaled only a teakwood door dexterously slammed in our face!

So passed the colonel!—we were glad of it. With a veteran's philosophy we gazed about the room.

Beneath a *chromo* of the Virgin, illumined by a burning candle at each side although the hour was not yet noon, hung a foot-

square Filipino flag. It was fair spoil of war, and we have it to this day.

From a gilt frame on a table the face of a pretty mestiza girl smiled up at us. We left it undisturbed for the flitted hero, if ever the fortune of war should permit him to claim his own.

And last and greatest find, in a drawer of an ebony bureau, we came upon a Spanish copy of "*Don Quixote*." Thereafter, whether we marched through towering jungles or stormed tiled-roofed towns, the Knight of La Mancha rode ever with us, mounted on bony Rosinante and accompanied by proverbing Sancho Panza.

At Misamis in Mindanao, where we released a group of blood-stained prisoners from stocks and shackles, the lean knight seemed to us to be sitting beside them, immured in his carriaged cage. In Balabac, loveliest and remotest island of the Sulu Sea, the loopholed tower wherein we spent a day observant of the enemy's pickets, seemed the windmill once engaged in joust by the good cavalier.

High policy of war made our presence necessary at a ball in Surigao—just where the Sulu Sea yields to the Pacific. With a revolver hidden under our coat ready for the enemy's sons, we danced with the enemy's daughters into the wee, sma' hours. In the person of a Visayan girl who spoke not a word of Spanish or English, or French, but whose eyes and smile held us entranced through half a dozen waltzes, we saw none other than the lovely Dulcinea del Toboso.

* * *

Our attention was first directed to the Koran when we were within the palisadoed hall of the Sultan of Sulu.

The sun had set after a long day of Ramadhan, and the time had come to break the holy fast. Muddy coffee, nondescript sugarcakes, and delicious mangoes, were being served by slaves naked to the waist. Over the slaves presided a major-domo whose sash was stuck full of wicked looking knives of assorted sizes.

There had been hours of acrid discussion concerning imposts and levies, between the Sultan and the commanding officer. There were but six Americans present to confront six score Moros, and more than once the chill breath of death had felt very near. Now

as the restrictions and temper of the holy day's fast were thrown off with the fading sun, our eyes fell upon an inscription on a brass plate let into the wall.

"A text from the Koran," explained the interpreter.

When we were again safe on board our ship, we sought out an English copy of the great Mohammedan script.

Let us confess that the Koran seemed to us to possess small merit of literary form, whatever it may own as a philosophical study or as a historical record of manners. We pursued our search for its charm through the intricacies of a score of its *surahs*. In vain. We would far rather flee with the Prophet in the hegira or bow with him before the Kaaba than read any of his revelations by the way!

* * *

A good deal tossed about by the northeast monsoon and with 70 men down from "breakbone fever," our little gunboat limped into the port of Siassi in the Sulu Archipelago. We were among those tortured by dengue—the surgeon declared we must have some distraction for fevered mind and body. The ship's library was a thing of shred and patches, but by a miracle it yielded "*Gil Blas*."

Reclining in a chair beneath the canvas double-awning, the sea-breeze eased the racked bones even as the humor of Le Sage's masterpiece relieved the weary brain.

So we owe a debt to the picaresque not lightly to be forgotten. Defoe's *Moll* and *Colonel Jack*, Smollett's *Roderick* and *Peregrine*, Fielding's *Joseph* and bluff *Tom Jones*, these are not so dear to us as *Gil Blas*, the supple rogue of Spain, slipping through every difficulty—to die in the odor of sanctity on his own estates. Even yet, when we dream at night with a touch of the old tropic malaria upon us, we hold the tattered pages of "*Gil Blas*," and hear, beyond the palm-crowned bluff, the thunder of the surf on the outer reef.

* * *

We read "*For the Term of His Natural Life*" while our ship lay at anchor in a harbor of Borneo. Above us, imminent, abrupt, formidable, loomed the heights of Mount Kinabalu, beloved of Dyak gods and devils. Among such cliffs might the bushrangers

of the island-continent still farther south have been lost after their escape from the prison-pen.

The Australian epic had been lent us by a fervent patriot of New South Wales. Our lack of knowledge that such a story existed had caused him as much surprise and horror as an Englishman's ignorance of "*The Last of the Mohicans*" might have caused an American. However, our apology was accepted, and the book was duly pressed upon us.

So we made delightful acquaintance with that tale which, without pretension to style, and frankly devoid of technic, yet has such charm of earnestness and truth, of clarity, and of restrained passion and power, as amply to justify the rank it is given by all Australians.

We finished reading "*For the Term of His Natural Life*" not long after we had assisted in bringing about the capture of a Moro outlaw, one Bebukan, known as the "wild boar of Basilan." After all, the bushranger is found in every land! It is necessary for the sake of civilization that his race be short and his end be sure, but—we grant him always a meed of pity.

* * *

How shall a mere naval officer, even although titularly reckless, dare to speak of Shakespeare?—of that Master Will who in the heaven of books is surely only a very little lower than the angels? Shakespeare for a seafarer? Why not? The surge of his majestic lines must reverberate in the souls of men who on their lawful occasions hear the thunder of the actual sea. Perhaps Shakespeare's lyrics usually make less appeal to the military mind than do his pentameters. But to some of us the lyrics bring mirth or melancholy as they alone can.

Certain salty lines recall to us a picture of a converted gunboat driven blind across the Celebes Sea before the northeast monsoon, ourselves sheltering from a pelting rain in the lee of the forward deckhouse, and a fireman at our side obliviously quoting to himself. It was Stephano's roaring lilt from "*The Tempest.*" What a relish in it for any man who goes down to the sea in ships!

"The master, the swabber, the boatswain, and I,
The gunner, and his mate,
Lov'd Mall, Meg, and Marian, and Margery,
But none of us car'd for Kate;
For she had a tongue with a tang,
Would cry to a sailor: *Go, hang!*"

There in the lee of the deckhouse, that melancholy day of the rainy season in the Celebes Sea, the fireman opened a corner of his heart to us—or, at least, a corner of his mind. Perhaps that corner of his mind still held a saving Oxonian grace. Be that as it may, there was for the time no barrier of rank between us and him—Shakespeare was a veritable solvent of such things. We matched each other in quotations from "*Love's Labour Lost,*" and "*As You Like It,*" and "*Cymbeline.*"

"When daisies pied, and violets blue,
 And lady-smocks all silver-white,
And cuckoo-buds of yellow hue
 Do paint the meadows with delight. . . ."

Had we not seen the daisies of Warwickshire and the violets of Kent when on liberty from our ship? And if one has ever emerged from the New Forest on one of those misty-bright or sunny-wet days found only in Hampshire, he will remember always how the ladysmocks gleamed before him, "all silvery-white" in very truth.

It seemed to us that the melancholy Jaques himself spoke in the fireman's husky tones:

"Who doth ambition shun,
And loves to live in the sun
Seeking the food he eats,
And pleas'd with what he gets,
 Come hither, come hither, come hither:
 Here shall he see no enemy,
 But winter and rough weather."

On the forest-clad hill of Santa Lucia in Santiago de Chile, the sun warms the Andean air. It is very pleasant to live in that sun! And on the slopes of Mount Tamalpais, beloved of every naval "Sloper," many an officer has ambition shunned—at least, for an hour! On Mariveles, in the Philippines, there can now be found no enemy, not even winter or rough weather; but we can remember when terror walked there by noonday as well as in darkness!

To naval officers who must so often live close to death—and in these days more than ever!—the requiem sung over Imogen in "*Cymbeline*" has a particular melody—and may put a sober period to these reckless comments on our reckless readings:

Fear no more the heat o' the sun,
 Nor the winter's furious rages;
Thou thy worldly task hast done,
 Home art gone, and ta'en thy wages:
Golden lads and lasses must
 As chimney-sweepers, come to dust.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ACCURATE TRAJECTORIES BY MECHANICAL INTEGRATION

By CAPTAIN E. F. EGGERT, Construction Corps, U. S. Navy

The problem of exterior ballistics, as it was left by Ingalls and Alger, had developed to the point where satisfactory accordance was obtained up to ranges that were fairly long. The integration of the ballistic formulæ was obtained analytically, using however approximations, certain variables being considered as constants.

It was known that these so-called constants could not be so considered after a certain limit had been reached in either range or angle of elevation, and beyond this limit the method failed to give satisfactory results, and no other method was known that would do so.

This limit, with modern heavy naval guns, was reached at about 20,000 yards, and, before the present war, naval practice was well within this limit, and no extension of the problem was required. Conditions have now changed, and the following method is intended to extend the satisfactory solution of the ballistic problem still further, to the possible limits of range of the present naval guns.

To show how much the Alger method falls short of accuracy at longer ranges, it is only necessary to calculate a few complete trajectories at such long ranges, work out the values of the so-called constants at a number of points, and find their means, for the trajectory. This has been done, and the following examples will show the discrepancy:

There are two constants that cause most of the error. These are, first, the so-called integration constant, B; and, second, the air density constant, f. (Alger uses β instead of B.)

The former, in the method now practiced, is considered equal to one, as an average of the whole trajectory. As a matter of

fact, when the value of B is worked out for all parts of any trajectory, it is seen that it is rarely less than one, and nearly always greater, so that its average value could never be strictly considered as equal to one. For instance, at a nominal range of 30,000 yards for the 16" gun of 2600 f. s. I. V., B is 1.09 at the gun, is reduced to 1.00 at the vertex, and increases again to 1.28 at the end of its travel. At 35,600 yards, these figures are 1.16, 1.00, and 1.35.

The means of the values of B for each trajectory, which should be compared with the assumed mean value of 1.000, are, for the same gun, as follows:

Nominal range	Mean B
15,000	1.008
20,000	1.018
25,000	1.032
30,000	1.063
35,600	1.080

When these values of B are substituted for the assumed value of 1.000 in the Alger or Ingalls ballistic formulæ, the nominal ranges, with a given angle of departure, are reduced, in some cases considerably. The amount of reduction of range can also be found approximately by the following method: If k is the percentage error in B, t the time of flight, x the mean horizontal retardation of the projectile, then the reduction in range is $\frac{1}{2}k x t^2$, which must be divided by 3 to reduce to yards. The value of x is found if we have the initial horizontal velocity V_h, and the range X (feet) traversed, since $X = V_h t - \frac{1}{2} x t^2$. This has been done for the above gun, and the following errors in range due to the error in B are found approximately:

Nominal range	ΔR_B (yards)
15,000	32
20,000	130
25,000	348
30,000	887
35,600	1445

Similar methods are followed in finding the error in f. This constant is found from a table of densities of the atmosphere for different heights above the surface of the earth, and any one value of f is the inverse of the density at the height of the projectile, the density at the surface being unity.

Alger assumes a mean value of f for the whole trajectory, equal to the value corresponding to a height equal to two-thirds the maximum ordinate. This is correct only when the orbit is a parabola, which is never the case at longer ranges.

The values of f have been found for each complete trajectory for the above gun, at a number of points, and the mean values derived. These means differ from the value corresponding to the height equal to two-thirds of the maximum ordinate, found by the Alger method, by amounts as follows:

Nominal range	Error in f (per cent)
15,000	0.2
20,000	0.4
25,000	1.6
30,000	2.6
35,600	5.9

These errors give approximate errors in range as follows:

Nominal range	ΔR_f (yards)
15,000	8
20,000	28
25,000	166
30,000	273
35,600	770

The above errors are of the same sign as those caused by the error in B, and both reduce the nominal range, when the angle of elevation is constant. The sum of the two errors must therefore be subtracted from the nominal range given by the Alger method, to get a closer approximation to the actual range.

There are two other minor sources of error, that caused by the assumption that g is constant and that caused by the assumption that g always acts in the same direction. As a matter of fact, at longer ranges g is less in the upper parts of the trajectory, and its direction, as the trajectory is traversed, inclines more and more from its original direction, the maximum inclination being the angle at the earth's center subtended by the line joining the two ends of the trajectory; or, roughly, if $\bar{p}$ is this angle in minutes of arc, $\bar{p} = \frac{R}{2000}$.

The former error will increase the range, the latter will reduce it, for a constant angle of elevation, and the errors are nearly

equal, so that it is practically safe to neglect these two causes of error, if the Alger method is used.

The amount of the latter error, in yards, is necessary in the method to be described later, and is found as follows: The inclination of g introduces a component equal to $g \sin p$, where p is the inclination of g at any point. In practical cases p is a small angle, and its sine is equal to the angle, also its cosine is practically unity, so that no vertical error results. The error in the horizontal retardation is therefore gp, and the maximum is $g\bar{p}$. Half the maximum can be taken as the mean value, and the error in range is therefore $\frac{1}{2}t^2 \cdot \frac{1}{2}g\bar{p}$, or $\frac{1}{4}g\bar{p}t^2$, in feet, or $\frac{1}{12}g\bar{p}t^2$ in yards. This error, called ΔR, for 35,600 yards nominal range, is 59 yards.

The errors in B and f above found were allowed for in the value of C in Alger's ballistic formulæ, for ranges of 15,000, 25,000, and 35,600 yards, and calculation by this method then showed a reduction of the range closely corresponding to the errors found by the approximations described above.

It will thus be seen that the Alger method, as applied to the 16″ gun, gives ranges that are too long by about the following amounts, using the adopted value of c, the coefficient of form, and including miscellaneous minor errors:

Nominal range	Error in range (yards)
15,000	50
20,000	170
25,000	500
30,000	1200
35,600	2600

At ranges less than 15,000, the errors are negligible. These errors are somewhat reduced, and that at 15,000 yards eliminated, when we change the value of c, the coefficient of form, from .70 to .69. It will be evident that, having neglected the errors in B and f at 15,000 yards, the range near which c was determined, the value of c adopted must be incorrect by the total of the errors in B, f, etc., and in a direction opposite to that of those errors. By reducing c to .69, the error in range at 15,000 yards disappears, and the errors at the longer ranges are slightly reduced, but not by more than about 250 yards at the maximum range.

By the method of mechanical integration described below, all the above errors are avoided, and the results of the mechanical

integration are practically in accordance with the results found by Alger's method, when the corrected values of the constants are used. These corrected values cannot, however, be predicted, so that Alger's method cannot be used for longer ranges. This restriction does not apply to the mechanical integration method, nor is there any restriction whatever to its use, as long as the basic assumption holds, that the axis of the shell remains tangent to the trajectory.

The method is also on theoretical grounds sufficiently accurate, if the time interval chosen is not too large, so that it can with confidence be used for high angle fire, as long as the axis of the shell stays in the trajectory.

BASIC ASSUMPTION

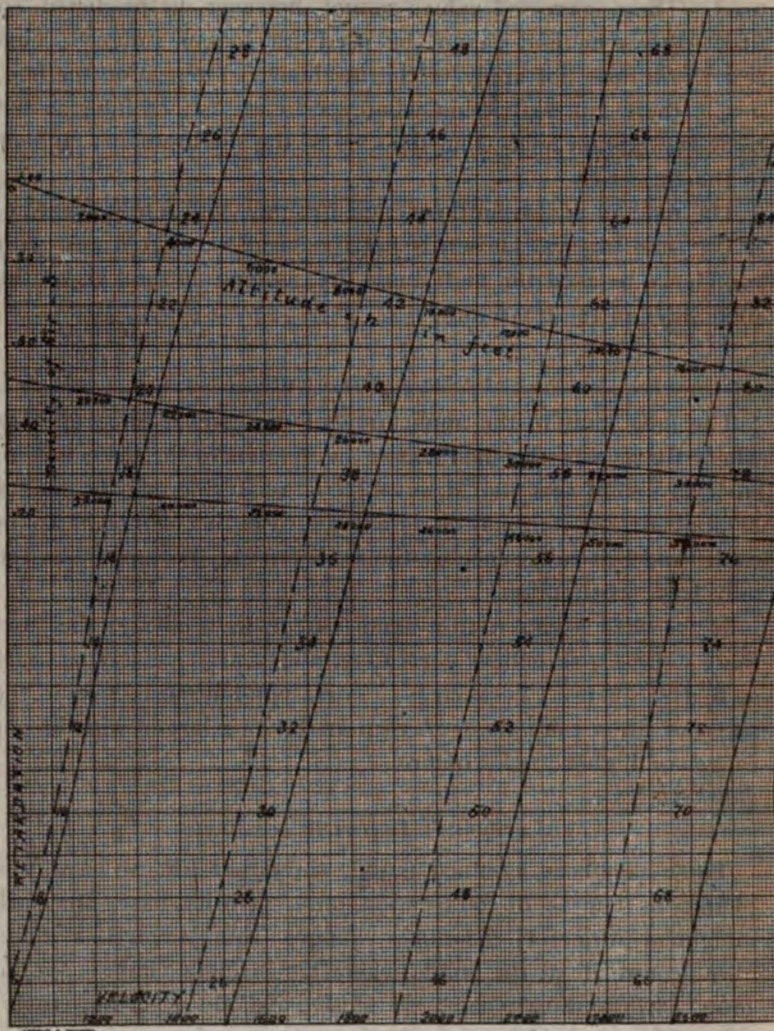
The only limit to the application of mechanical integration is where the axis of the shell leaves the tangent to the trajectory to such an extent that the Mayevski friction results can no longer be applied. As long as this is not the case, the method is applicable, and this adherence of the shell axis to the tangent is the only basic assumption.

If the shell leaves it to a small extent, as is always the case, there will be a secondary correction, which, transversely, appears as drift. There is, necessarily, a corresponding correction in the plane of fire. Both these corrections become larger with longer ranges or higher angles of fire.

MAYEVSKI'S FRICTION RESULTS

These have been assumed as they stand, but for use have been plotted as curves of retardation on a velocity base, for each individual projectile. The only changes from Mayevski's values have been made at the points where his formulæ change, viz., at 1800, 1370, and 1230 f. s. If plotted exactly according to his values, there would be cusps in the curves at these points. This is obviously impossible, and the curves have been faired off at these points, not enough, however, to make any appreciable change in results.

Sheet A shows such curves for the 14" and 16" guns, with projectiles having a coefficient of form of .69.



SHEET A.

14" shells .... $C = .69$ $\delta = 1.0$
16" shells .... $C = .69$ $\delta = 1.0$

This sheet also shows curves of air density at various heights. These are necessary to correct the retardation results from the

former curves, since these are plotted for unit air density. When the retardation for any velocity is found from the first curves, it is multiplied by the air density corresponding to the height at which the projectile is then located.

The air-density curve is plotted from the equation of densities found by Bessel to satisfy refraction data, as shown in Chauvenet's discussion of atmospheric refraction, and corresponds closely to similar data assumed by Alger and Ingalls.

FUNDAMENTAL CONSIDERATIONS

Suppose that at a known point in the air, the direction and amount of motion, or the velocity V, of the projectile are known. The retardation caused by the air friction will be in the direction of V, at that instant, and its amount is given by the curves. The velocity V can be resolved into vertical and horizontal components, V_v and V_h, and likewise the retardation r at this point can be similarly resolved into r_v and r_h, these latter being in the same ratio to r as are V_v and V_h to V.

After an indefinitely small time, dt, the velocity V has been reduced by air friction by the amount rdt. This can be resolved into $r_h = rdt \frac{V_h}{V}$, and $r_v = rdt \frac{V_v}{V}$, these being the horizontal and vertical components, or the reductions in the horizontal and vertical velocities.

In the same interval of time, gravity causes a further reduction in the vertical velocity, considering a velocity upwards as positive, amounting to gdt.

The velocity horizontally has then, in the interval of time dt, been reduced to $V_h - rdt \frac{V_h}{V}$, and the velocity vertically has been reduced to $V_v - \left(rdt \frac{V_v}{V} + gdt\right)$.

The combination of these new components of the velocity by means of a table of squares or similar means gives a new velocity V along the tangent, whence a new value of r can be deduced.

If we take the mean of the two vertical velocities and multiply by dt, we get the vertical travel during this interval, and, likewise, from the two horizontal velocities, the horizontal travel, whence

the coordinates Y and X at the new point can be determined, since the coordinates at the original point are known.

In this way, step by step, we can find V, r, X, and Y, by intervals of dt. This is the method of analytical geometry.

MECHANICAL INTEGRATION

The interval dt is indefinitely small, and unless some method can be found for determining a soluble equation of motion, the analytical method is impracticable.

If, however, we take n successive intervals, each equal to dt, and if the successive values of r are r, r_1, and r_2, etc., and of V, V_h, and V_v, similar quantities with the proper suffixes, then after an interval of time ndt the horizontal velocity would be

$$V_h - \left[r\frac{V_h}{V} + r_1\frac{V_{h_1}}{V_1} \dots + r_n\frac{V_{h_n}}{V_n}\right] dt, \text{ or } V_h - ndt \cdot \frac{1}{n}\Sigma r\frac{V_h}{V},$$

and the vertical velocity would be

$$V_v - ndt \cdot \frac{1}{n}\Sigma r\frac{V_v}{V} - ndt\,\frac{\Sigma g}{n}.$$

The time interval ndt is now a measurable quantity, and can be called Δt. The quantity $\frac{1}{n}\Sigma r\frac{V_h}{V}$ is the mean value during the interval Δt of the horizontal component of the retardation r, the quantity $\frac{1}{n}\Sigma r\frac{V_v}{V}$ is likewise the means of the vertical component of r, and $\frac{\Sigma g}{n}$ is the mean value of g during the interval.

During a definite time interval Δt therefore, the horizontal velocity V_h has been reduced to $V_h - r_h'\Delta t$, and the vertical velocity from V_v to $V_v - r_v'\Delta t - g'\Delta t$, where r_h', r_v', and g' are the mean values of the quantities r_h, r_v, and g during the interval Δt.

Now, if the interval Δt is not too large, the mean values r_h', r_v', and g' are for practical purposes the same as the means of the values of r_h, r_v, and g at the beginning and end of the interval Δt. The first set of values we know, since we know V, V_h, and V_v.

The second set is found as follows, by the well-known method of successive approximations:

Having tabulated V_h, V_v, V, r, r_h, r_v, and g for the first known position of the projectile, we estimate new values of r_h, r_v, and g

after the interval of time Δt. The value of g changes very slowly and no great error is involved in assuming the new value the same as the old.

Having assumed the next values, the means of the two values of r_h, r_v, and g are taken, and new values are found for V_h and V_v by subtracting from the first values of V_h the mean of the two values of r_h, multiplied by Δt, and from the first value of V_v the mean of the two values of r_v, plus the mean of the two values of g, each multiplied by Δt.

Having thus found approximate values of V_h and V_v at the end of the interval Δt, they are combined by a table of squares or similar means to give the new value of V. A new value of r is now taken from the curves, for the new value of V, and it is corrected for height by finding the value of δ corresponding to the new height, and multiplying r by this value of δ. The new height is easily estimated, differing from the old height approximately by $V_v \Delta t$.

With the new value of r, corrected for height, we find new values of r_h and r_v. If the originally assumed values of these quantities had been correct, they would be the same as those now found. If not, we repeat the operation, using the new values found for r_h and r_v.

After one or two of these successive approximations, we find that the values of the quantities for the end of the interval remain unchanged. They are then the correct quantities.

Having now found V_h and V_v for the beginning and end of the interval of time Δt, the horizontal travel in the interval, or ΔX, is Δt times the mean of the two values V_h, and the vertical travel, or ΔY, is Δt times the mean of the two values of V_v.

Knowing the original coordinates X and Y, we now find the new ones by applying ΔX and ΔY.

PRACTICAL APPLICATION

Sheet B shows a form used for working out a trajectory. The first values, for $t = 0$, are the muzzle velocity for V, coordinates X and Y each zero (in the usual case), and other values derived from V.

These values being tabulated, new values of r_h and r_v are assumed and tabulated for the next interval. Without experience

or other guide there is not much accuracy to be expected in this first approximation.

The two values of r_h are now averaged, and the average, multiplied by Δt, subtracted from V_h. Likewise, the two values of r_v are averaged, and, after the value of g has been added to this average, the sum is multiplied by Δt and the product subtracted from V_v. Thus new values of V_h and V_v are tabulated.

$16'' - 2600 - c = .69 \qquad \phi = 12^\circ - 52'.5$

t	V_h	V_v	V		p	p_h		p_v		g	ΔX	X	ΔY	Y
0	2534.6	579.4	2600	71	67.1	65.4	4.1	15.0	1.8	32.2	2502.9	0	556.2	0
1	2471.2	533.1	2529	68	62.7	61.3	3.7	13.2	1.6		2441.5	2502.9	510.8	556.2
2	2411.8	488.5	2461	63	58.8	57.6	3.4	11.6	1.4		2383.8	4944.4	467.0	1067.0
3	2355.9	445.4	2398	59	55.2	54.2	2.9	10.2	1.2		2329.5	7328.2	424.5	1534.0
4	2303.1	403.6	2339	57	52.1	51.3	2.5	9.0	1.1		2278.1	9657.7	383.2	1958.5
5	2253.1	362.9	2282	53	49.4	48.8	2.4	7.9	1.1		2229.3	11935.8	343.1	2341.7
6	2205.5	323.3	2229	50	46.9	46.4	2.2	6.8	1.0		2182.8	14165.1	304.0	2684.8
7	2160.2	284.8	2179	48	44.6	44.2	2.0	5.8	.9		2138.6	16347.9	266.0	2988.8
8	2117.0	247.3	2131	45	42.5	42.2	1.7	4.9	.8	32.1	2096.4	18486.5	229.0	3254.8
9	2075.7	210.7	2086	42	40.7	40.5	1.5	4.1	.7		2055.8	20582.9	192.8	3483.8
10	2035.9	174.8	2044	41	39.1	39.0	1.6	3.4	.8		2016.8	22638.7	157.2	3676.6
11	1997.7	139.7	2003	39	37.5	37.4	1.3	2.6	.7		1979.3	24655.5	122.6	3833.8
12	1960.9	105.4	1964	37	36.2	36.1	1.3	1.9	.6		1943.2	26634.8	88.6	3956.4
13	1925.5	71.7	1927	35	34.8	34.8	1.1	1.3	.6		1908.4	28578.0	55.2	4045.0
14	1891.3	38.6	1892	34	33.7	33.7	1.1	.7	.6		1874.7	30486.4	22.4	4100.2
15	1858.1	6.1	1858	32	32.6	32.6	1.0	.1	.5		1842.0	32361.1	− 9.8	4122.6
16	1826.0	− 25.8	1826	30	31.6	31.6	1.0	− .4	.6		1810.4	34203.1	− 41.5	4112.8
17	1794.9	− 57.2	1796	29	30.6	30.6	.8	− 1.0	.5		1779.8	36013.5	− 72.6	4071.3
18	1764.7	− 88.1	1767	28	29.9	29.8	.8	− 1.5	.5		1750.0	37793.3	− 103.2	3998.7
19	1735.3	−118.4	1739	26	29.1	29.0	.7	− 2.0	.5		1721.0	39543.3	− 133.4	3895.5
20	1706.7	−148.3	1713	25	28.4	28.3	.7	− 2.5	.4		1692.7	41264.3	− 163.0	3762.1
21	1678.7	−177.3	1688	24	27.8	27.6	.5	− 2.9	.5		1665.0	42957.0	− 192.2	3599.1
22	1651.3	−206.6	1664	22	27.3	27.1	.6	− 3.4	.4		1637.9	44622.0	− 220.8	3406.9
23	1624.5	−235.1	1642	22	26.8	26.5	.6	− 3.8	.5		1611.4	46259.9	− 249.2	3186.1
24	1598.3	−263.2	1620	20	26.3	25.9	.5	− 4.3	.4	32.2	1585.5	47871.3	− 277.0	2936.9
25	1572.7	−290.8	1600	20	25.8	25.4	.5	− 4.7	.4		1560.1	49456.8	− 304.4	2659.9
26	1547.5	−318.1	1580	18	25.4	24.9	.4	− 5.1	.4		1535.2	51016.9	− 331.6	2355.5
27	1522.8	−345.0	1562	18	25.1	24.5	.5	− 5.5	.4		1510.7	52552.1	− 358.2	2023.9
28	1498.6	−371.5	1544	16	24.7	24.0	.4	− 5.9	.5		1486.7	54062.8	− 384.5	1665.7
29	1474.8	−397.5	1528	15	24.5	23.6	.3	− 6.4	.4		1463.1	55549.5	− 410.3	1281.2
30	1451.4	−423.1	1513	15	24.3	23.3	.2	− 6.8	.4		1439.8	57012.6	− 435.7	870.9
31	1428.2	−448.3	1498	13	24.2	23.1	.2	− 7.2	.5		1416.7	58452.4	− 460.7	435.2
32	1405.2	−473.1	1485		24.2	22.9		− 7.7			−76.1	59869.1		−25.5
31.95			1486									59793.0		0

$$\tan \omega = \frac{473.1}{1405.2} = .337 \qquad \begin{array}{r} = 19931 \text{ yds.} \\ \Delta R \quad - 8 \\ \hline R = 19923 \end{array}$$

$$\omega = 18^\circ - 35'$$

SHEET B.

These are now combined into a new value of V, by using a table of squares if the angle of departure is large, or by the use of a slide rule if it is small. In the latter case, V is found by increasing V_h by the quantity $\frac{1}{2}\frac{V_v^2}{V_h}$.

We now consult the curves, and obtain for the value of V the corresponding value of r. Estimating the altitude of the projectile at the end of the interval, we also take the proper value of

δ from the curves, and multiply r by δ. The product is the proper new value of r to be tabulated. This is now multiplied, by slide rule, by $\frac{V_h}{V}$ to get r_h, and by $\frac{V_v}{V}$ to get r_v.

We now usually find a small difference between the assumed and derived new values of r_h and r_v. The derived values are substituted, new averages of r_h and r_v found, and V_h and V_v corrected. In most cases it is unnecessary to correct further.

The two values of V_h and V_v are then averaged, multiplied by Δt, and tabulated as ΔX and ΔY. These are then added to the previous values (in this case zero) of X and Y to find the succeeding values.

The process is then repeated for the next interval of time, and so on, until the value of Y again becomes zero, or the value that is finally wanted.

The remaining steps are obvious.

The last remaining correction is found by interpolation, the final value of X divided by 3 to change it to yards, and the value of ΔR, above described (see page 74), is subtracted to get the corrected value of R.

It will be noted that Δt, the time interval, is 1 second. This simplifies the calculations considerably, and for ordinary trajectories it is sufficiently small. It is possible, for the longer trajectories, to use a larger interval without great error, and the amount of this error can be estimated. For smaller trajectories, for instance with small-arms, it would be necessary to use a shorter interval, in some cases as small as one-tenth second. This is because the value of r changes rapidly.

The values of all quantities used are determined to the nearest tenth of a unit when $\Delta t = 1$, except for V, which is determined to the nearest unit. Closer approximation is not necessary, if the old mathematical rule is followed that a fractional result is given to the nearest last significant figure used, and that if the fraction is one-half, the nearest figure is used which is even, not odd.

The columns of differences are very important, tending to control the accuracy and indicate errors before the work has gone too far. The differences at r_h and r_v are also important to determine the values of the next succeeding quantities.

The 20″ slide rule is all that is necessary for this work, except that at angles of the trajectory greater than about 20° it is more

convenient to use a table of squares to find V. A third term in the series for the square can be used for the larger angles.

The values of V_h and V_v should be kept closely corrected, as on them depends a good deal of the accuracy of the results. As V is used only to determine r, it is not necessary to find it to a greater approximation than the unit.

For rough results at long ranges, much time is saved, and the great tediousness of the process avoided, by making Δt larger, say 5 seconds or even 10 seconds.

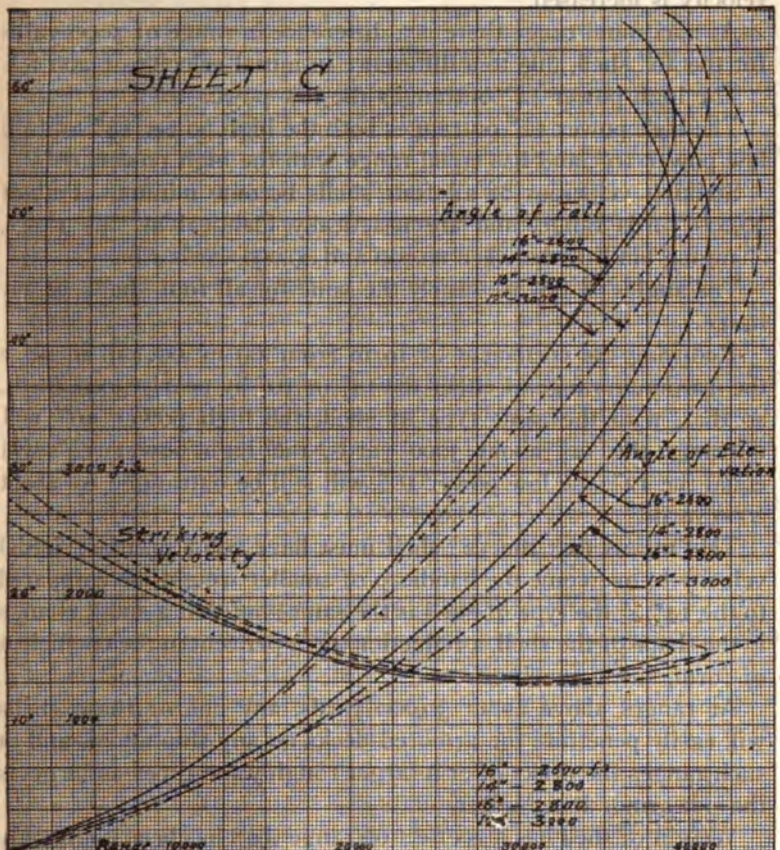
Calculations have been made of trajectories with time intervals 1 second, 5 seconds, and 10 seconds. At a nominal range of 30,000 yards, for the 16" gun, the longer interval gives shorter ranges, the differences from that given by the 1-second interval being 0.5 per cent for the 5-second interval, and 1.8 per cent for the 10-second interval. When these results are plotted in a curve of percentage error on a base of time interval, it is seen that the error rises rapidly as the interval increases, but the error with intervals between 1 and 5 is small, and the variation in error, at the former figure, is also small. From this consideration it appears that, although the integration with an interval of 1 second gives results that are too small, the error is only of the order of one-tenth of 1 per cent, or even less, at a range for the 16" gun of 30,000 yards.

Calculations were likewise carried out for the same gun at an angle of elevation of 50°, for intervals of 1 and 10 seconds. The variation was 3.5 per cent; as the time of flight was 101 seconds, while that for the 30,000 yards range was 54 seconds, it appears that the percentage error with a time interval of 10 seconds is nearly proportional to the time of flight, and the amount of this error, for this gun, is .035 per cent per second of flight.

It appears, however, from such investigation as has been so far possible, that this error has this value only at the longer ranges. At ranges less than about 30,000 yards the positive error is reduced, and becomes negative at ranges around 10,000 to 15,000 yards.

The amount and character of this error seem also to be nearly the same for the different shells used in this investigation.

A time interval of 2 seconds has also been used considerably, with still further simplification in the mathematical processes, and has given satisfactory results.



SHEET C.

CONCLUSION

Sheet C shows the results of calculations made by the mechanical integration process for four actual or possible types of shells, as follows:

Caliber	Weight	Initial velocity	Coefficient of form
16"	2100	2800	.69
16"	2100	2600	.69
14"	1400	2800	.69
12"	870	3000	.60

The following general results are deduced from these curves:

Maximum range is obtained at an angle of elevation of nearly 50°, but there appears to be an increase in this angle as the velocity is increased.

At maximum range there is a difference in range of 5000 yards for the 16″ shell, due to a difference in initial velocity of 200 f. s.

The high power 14″ outranges the low power 16″.

The high power 12″ outranges both the high power 14″ and the low power 16″, and has equal range with the high power 16″.

Striking velocities of all four shells become minima at about 30,000 yards range, and are practically identical at this range, changing but little between 20,000 and 40,000 yards range.

The angles of fall are nearly the same for all four shells, at any range.

Reducing the coefficient of form from .69 to .60 will increase the maximum range of either the 14″ or 16″ by nearly 3000 yards, so that, with the same type of shell, the high power 16″ will outrange the 12″ about 3000 yards, the high power 14″ will equal the 12″, the low power 16″ will still be outranged by about 2000 yards.

This means that the 12″ shell must have 200 f. s. more initial velocity to overcome the handicap of smaller weight, as compared to the 14″, if the type of shell is the same; but that a small change in the shape of the shell, a reduction of 13 per cent in the coefficient of form, has as much effect.

At ranges above about 30,000 yards, any one of these shells will easily penetrate the armored decks on any ship afloat, and at such ranges the decks offer a target roughly ten times as large as the side armor above water.

Weight of shell has less effect on range than has been commonly supposed, and greater ranges must be obtained by increased initial velocities, or by changes in the type of shell.

STATEMENT OF BOARD OF CONTROL

The " War Notes " will be discontinued from January, 1919. Such further notes on the war as are included will appear under " Professional Notes."

The strict censorship enforced during the war made it impossible to obtain official confirmation of naval events. Two courses were open: to publish only the few things that were officially given out, or to publish extracts from papers which appeared to have some foundation of fact. The second course was followed, the authority for the article being given in each case, in order that the reader might form his own judgment of the value of the article.

The strict censorship forbade the printing of any articles on strategy, tactics, material, organization or personnel. Also the small number of articles submitted has not permitted of any choice, but has necessitated the publication of practically all articles on hand at each issue. The board trusts that the members realize the difficulties that have been encountered in the endeavor to continue their publication.

It is hoped and expected that the censorship will in the future be less severe and that members will find it convenient to devote more time to the writing of articles, in order that the PROCEEDINGS may again provide its members with scientific and professional matter which will be of great value and benefit, and this can only be accomplished by the united effort of all members.

COLONEL D. WILLIAMS, U. S. M. C.
CAPTAIN W. H. STANDLEY, U. S. N.
CAPTAIN A. ST. C. SMITH, U. S. N.
CAPTAIN J. G. CHURCH, U. S. N.
COMDR. J. A. FURER, C. C. U. S. N.
Board of Control,
U. S. Naval Institute.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Changes in the Officers of the Institute

Commander John Downes, U. S. Navy, on being detached from the Naval Academy, resigned from the Board of Control: Captain David Potter, Pay Corps U. S. Navy, was selected by the Board to fill the vacancy.

Dues.

The annual dues ($2.50) for the year 1919 are now payable.

Book Announcements

Orders for all books published by the Institute can now be filled on receipt of orders. The French Nautical Phrase Book and Reader and The Spanish Nautical Phrase Book and Reader are being revised; the revised edition will be out about March 1.

Membership

Life, regular and associate membership, 5651.
Resignations: One.
Deaths: Lieut. Comdr. E. E. Bell, P. C. U. S. N.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS *are to be sent, and thus insure their receipt. This precaution is now of particular importance as notices of changes of stations are not now available for use of the Institute's staff.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 10th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations

Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice

Whole Nos. 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS (March, 1913, June, 1913, September 1913, January-February, 1914, January-February, 1915, and November-December, 1916, January, 1918) are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 25 cents per copy.

ANNAPOLIS, MD., December 15, 1918.

INFORMATION INDEX

The Actual Surrender of the German Torpedo Flotilla.

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER W. B. JUPP, U. S. Navy

GENERAL ARRANGEMENT

These articles have been taken from various periodicals and newspapers. The Institute has not at any time had any official means of confirming them or establishing their accuracy and they have been incorporated for what they are worth.

GERMANY

"DER TAG."—GERMAN FLEET'S SURRENDER.—The first and main instalment of the German High Sea Fleet surrendered to Admiral Sir David Beatty, the Commander-in-Chief of the Grand Fleet, off the Firth of Forth, November 21, 1918.

The full list of the ships is as follows:

BATTLESHIPS

Friedrich der Grosse, flying the flag of Rear Admiral von Reuter, who was in command of the whole force.

Konig Albert,	*Bayern,*
Kaiser,	*Markgraf,*
Kronprinz Wilhelm,	*Prinz-Regent Luitpold,*
Kaiserin,	*Grosser Kurfurst.*

BATTLE CRUISERS

Seydlitz, flying the broad pennant of Commodore Taegert.

Derfflinger,	*Hindenburg,*
Von der Tann,	*Moltke.*

LIGHT CRUISERS

Karlsruhe, flying the broad pennant of Commodore Harder.

Frankfort,	*Brummer,*
Emden,	*Koln,*
Nurnberg,	*Bremse.*

DESTROYERS

Forty-nine of the latest type from the 1st, 2d, 3d, 6th, and 7th flotillas.

The sun has just gone down on the most wonderful day in all the long history of war by sea. A great navy, once proud in its young strength and in its high imperial mission, gave, the morning of November 21, into ignominious captivity, more than threescore of its biggest and best ships. The finest vessels in the German Fleet, fashioned at heavy cost in taxes and debt, to be alike the symbol and the engine of Germany's world ambitions, have surrendered themselves as hostages to the Allies.

Even as I write the captive ships lie but a few miles away in British waters "fast bound in misery and iron," the tragic semblance of a navy which lost its soul. History tells of many a good ship which struck its flag under the stress of battle. History tells also of ships which faced destruction rather than surrender. Research may reveal cases in which a group of ships surrendered as it were in cold blood without the striking of a blow. But the annals of naval warfare hold no parallel to the memorable event which it has been my privilege to witness to-day. It was the passing of a whole fleet, and it marked the final and ignoble abandonment of a vainglorious challenge to the naval supremacy of Britain. I watched the scene from the flagship of the British Commander-in-Chief. Never has pageant so majestically demonstrated the might of Britain's Navy. The Dominions of Australia, Canada, South Africa, and New Zealand had their places in the spectacle. American and French warships too were there. But above all else, this was the day of the British Navy, the supreme reward of unceasing vigilance and unrelenting noiseless pressure on the vitals of Germany.

Awaiting the Day.—For the last two or three days the Grand Fleet has breathed a quickening, electrified air. You detected its invigorating virtue in the half-stifled excitement of the men of the fleet. Since Armistice night, when flag officers sang and danced on the forecastle deck with seamen and marines, every ship attached to the fleet, from the flagship to the fussiest little motor launch, has been full of joyousness, restrained in its expression, but real and irrepressible. In the *Queen Elizabeth,* the most crowded of all the ships, the anticipation of surrender day has grown almost hour by hour as messages flashed hundreds of miles through the air to and from the German High Sea command.

The coming of the *Königsberg* and the historic meeting between Sir David Beatty and Admiral Meurer were fresh in each mind when I came on board two days ago. In the moonlight that evening three merry young officers reconstructed the scene on the quarterdeck for me with mock solemnity. Yesterday the expectation of the unbelievable climax drove all other thoughts from the mind, and as time went by, and scraps of news passed from mouth to mouth, the atmosphere of eagerness grew even more intense. But it was still a controlled emotion. Naval men pretend to be as unemotional as a jellyfish. Of course they are not. Yet it must be confessed that few in the *Queen Elizabeth*—the "Q. E.," as the fleet calls her—spent as sleepless a night as your correspondent.

Admiral Beatty's Orders.—Early in the afternoon two notices were posted in the ward room, which deserve to be put on record. One was as follows:

Relations With the Germans.—The following is a copy of a memorandum issued by the Commander-in-Chief, Grand Fleet:

(1) It is to be impressed on all officers and men that a state of war exists during the armistice.

(2) Their relations with officers and men of the German Navy with whom they may now be brought into contact are to be of a strictly formal character.

(3) In dealing with the late enemy, while courtesy is obligatory, the methods with which they have waged the war must not be forgotten.

(4) No international compliments are to be paid and all conversation is forbidden, except in regard to the immediate business to be transacted.

(5) If it is necessary to provide food for German officers and men they should not be entertained, but it should be served to them in a place specially set apart. If it is necessary to accept food from the Germans a request is to be made that it is to be similarly served.

It may be added at once that these injunctions against anything which might even appear to be fraternization with the enemy are thoroughly in keeping with the attitude of mind, both of officers and of men, towards the Germans. In any ordinary circumstances nobody is more magnanimous towards a beaten foe than the British naval officer or seaman. But I have not these three days met a single man, whether of high position or of the humblest rank, who has the least compassion for the present enemy. His fleet are still "The Huns," and though most naval men admit that the German surface craft in the early days of the war generally observed the laws of humanity, it is, nevertheless, remembered that German officers saved from German ships sunk in the Heligoland Bight in August, 1914, spat in the faces of the British rescuers. Even if that and much else were forgotten, there would remain the inevitable shrinking from intercourse with any man who sailed under the pirate flag of the Imperial German Navy.

A Remarkable Note.—The second notice, posted yesterday evening, bears the signature of Geoffrey Blake, commander of the *Queen Elizabeth*. It is headed, "Program for Operation ZZ." Parenthetically, I may explain, for the benefit of any who share my own previous ignorance, that "ZZ" is the description applied for the purpose of the maneuvers and exercises of pre-war days to an unspecified position in which sections of the fleet were to meet. The notice begins:

"*Queen Elizabeth* will slip at 04.45, passing May Island at 08.00, and meeting the German Fleet at 09.40 approximately."

This, being interpreted, meant that the ship was due to sail at a quarter to 5 this morning, and to come up with the Germans at 20 minutes before 10 o'clock. The notice went on to set out the time-table for the routine of sailing, leading up to "action stations" at 9 o'clock. Here came the significant reminder that "immediate readiness for action is to be assumed," and definite instructions with regard to the position and training of turrets and guns. "It is hoped," the notice went on, "that arrangements may be made to allow all hands to see the German ships." Finally came the most remarkable note ever posted, certainly in this ship, and probably in any ship: "*09.40 battle fleet meet the German Fleet.*" It was generally known that by the terms of the armistice the German ships were to be unarmed and manned only by navigating crews, but the navy does not believe in taking unnecessary chances. Treachery was not expected, but all was ready to blow the German ships out of the water should any trick be attempted.

Last night the Grand Fleet lay at its moorings in the Firth of Forth. Above the bridge were battleships, destroyers, and submarines, and conspicuous among them was the French armored cruiser *Amiral Aube*, flying the flag of Rear Admiral Grasset, which, with two destroyers, represented the French Navy in the final act of the great drama. Below the bridge were battleships, battle-cruisers, and light cruisers, and again

a prominent place was taken by ships of a partner nation in the struggle, the *New York*, flying the flag of Admiral Rodman, with Admiral Sims and his staff on board, and the *Florida, Wyoming*, and *Arkansas*. Canada was above the bridge with the First Battle Squadron. Australia and New Zealand were below with the Second Battle Cruiser Squadron. Throughout the night the flagship was in touch by wireless with the German Fleet, noting its progress towards the place of rendezvous. At two o'clock in the morning the fleet was reported about 70 miles from the spot. German envoys who came in the *Königsberg* last Friday had stated that for some reason, of which I am not aware, perhaps for want of attention and perhaps for lack of fuel, their fleet would be unable to steam at more than 12 knots. That, however, would be speed enough for punctuality.

Leaving the Firth.—A few minutes before 4 o'clock the First Battle Squadron, led by the *Revenge*, flagship of Vice Admiral Madden, began to move. The fog had lifted, after five days, and the lower air was clear, but clouds hid the moon and stars and made the night dark. Silently through the darkness ship followed ship down to the open sea, an ominous, awe-inspiring procession of black shapes, each indistinctly silhouetted against the sky and canopied with a smudge of smoke. The *Queen Elizabeth* took her place near the end of the line. By daybreak the Grand

GERMANY'S SURRENDERED NAVY.

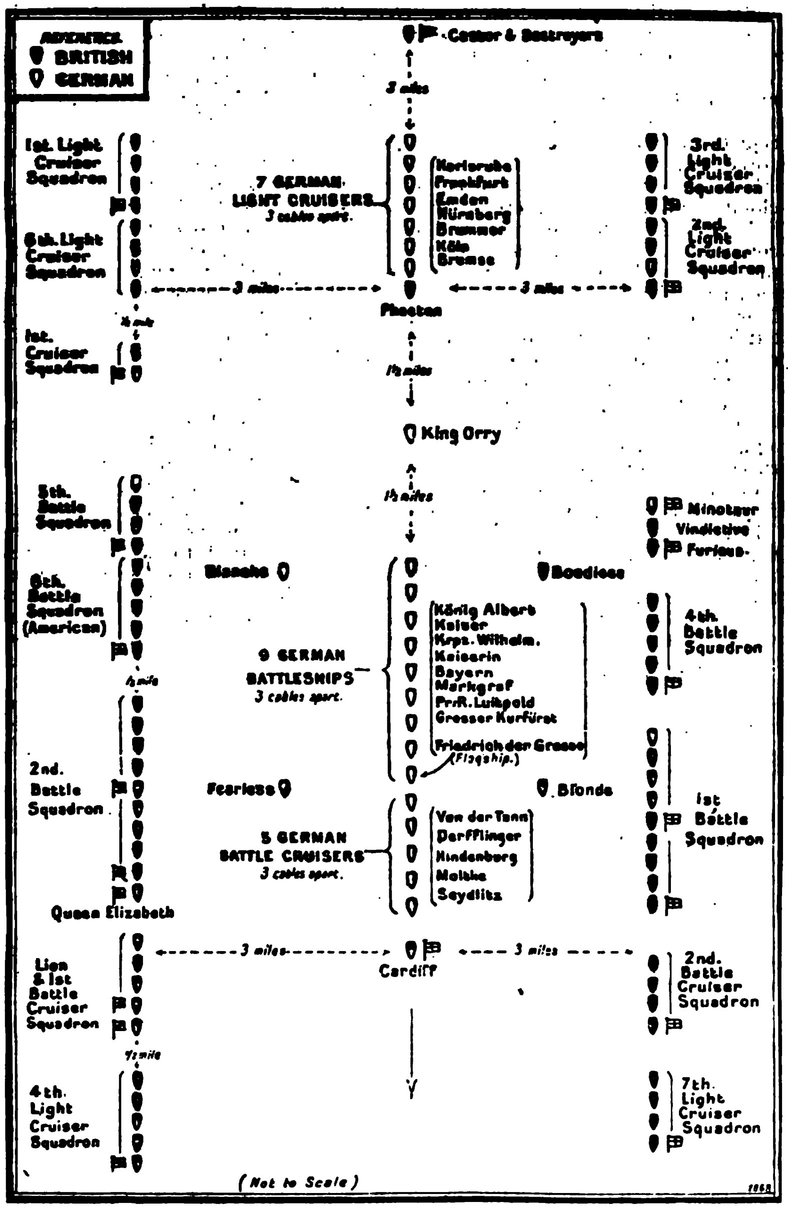
Thirteen ships of the line, six light cruisers, and fifty destroyers were turned over to British, American, and French naval forces. Germany also surrendered the battleship *König* and the cruiser *Mackensen* at a German port to a British naval officer sent to Germany to take over these ships, one of which was unseaworthy and the other unfinished. In addition, Germany is surrendering her entire submarine fleet to the Allies.

Fleet was at sea, and in the grey morning mist the squadrons took up position in two columns in single line ahead. The northern line was composed as follows:

First Light Cruiser Squadron (four ships).
Sixth Light Cruiser Squadron (four).
First Cruiser Squadron (two).
Fifth Battle Squadron (four).
Sixth Battle Squadron (five).
Second Battle Squadron (nine).
Queen Elizabeth.
Lion.
First Battle Cruiser Squadron (four).
Fourth Light Cruiser Squadron (five).

The southern line, on a parallel course six miles away, consisted of the following:

Third Light Cruiser Squadron (four ships).
Second Light Cruiser Squadron (four).
Minotaur.
Furious.
Fourth Battle Squadron (five).
First Battle Squadron (nine).
Second Battle Cruiser Squadron (four).
Seventh Light Cruiser Squadron (four).



ENEMY WARSHIPS AND THEIR ESCORT.

The above diagram shows the order of the British Fleet escorting units of the German High Seas Fleet for internment.—*London Times.*

Between the lines were the *King Orry, Blanche, Boadicea, Fearless,* and *Blonde* to act as repeating ships. In this order the Grand Fleet approached the rendezvous, "X position, lat. 56 deg., 11 min. N., long., 10 deg. 20 min. W." According to program the First Light Cruiser Squadron was due to meet the German Fleet at 10 minutes after 9 o'clock, but the position of greatest honor was to be filled by the *Cardiff*, of the Sixth Light Cruiser Squadron, for she was "to direct the movements of the German main force and order them to proceed, if possible, at a speed of 12 knots." About 8 o'clock the sun showed its rim through a rift in the slate-grey clouds, and here and there in the sky the greyness of lead melted into light shades of blue and brick red, but a haze still hung over the water and confined the vision to, perhaps, five or six miles. Somewhere away to the south we knew there were ships, but in a line which, from end to end, measured at least 15 miles obviously were ships which were not to be seen. Now and then in the distance one could pick out dimly the outline of a battleship; to identify it was another matter. So the two lines moved towards the oncoming enemy. Away to the north we passed the *Amiral Aube* and her attendant destroyer.

The Enemy Sighted.—Half-past 8 came and with it the report that the German Fleet had been sighted by our destroyers. An hour passed and the sun, rising in the heavens, began to tinge the sky with gold. Presently three, four, or five miles away on our starboard bow there came into view a "sausage" balloon towed by the *Cardiff*. At first it was a mere faint speck in a grey mist, with a slight smoke trail stretching out below. Then behind the *Cardiff* there emerged from the murk the first of the German ships. At three miles' range they appeared to be little more than slowly moving silhouettes. On coming abreast of the German Fleet the British Fleet turned by squadrons, 16 points outwards, wheeling, that is to say, back on its own track, retaining positions on both sides of the Germans to escort them to their anchorage. The order of squadrons as already given for the northern and southern lines was thus reversed.

Between the lines came the Germans, led by the *Cardiff*, and looking for all the world like a school of leviathans led by a minnow. Over them flew a British naval airship. First came the battle cruisers headed by the *Seydlitz*, a ship which carries the scars of the Dogger Bank battle of January, 1915. The *Moltke* and the *Hindenburg* followed, then the *Derfflinger*, also badly battered in the Dogger Bank engagement, and finally the *Von Der Tann*, which, according to report, suffered heavily in the naval air raid on Cuxhaven. On either side moved the *Fearless* and the *Blonde* in their former stations. The nine battleships followed at intervals of three cables. The five ships of the Kaiser class came first, then the *Bayern*, and then the three *Königs*, but in what order within the classes could not be told. A mile and a half astern was the *King Orry*, and again at the same interval the *Phæton*, of the First Light Cruisers. The *Castor*, flying the pennant of Commodore Tweedie, Commodore of Flotillas, led the 50 German destroyers, surrounded by nearly 150 British.

This bald description of the plan of the operation will not convey to the mind any conception of the scene, but it must be placed on permanent record, for it indicates a disposition of hostile fleets such as has never been seen before and will in all likelihood never be seen again. The operations were perfect, both in organization and in execution. From the purely spectacular point of view the pageant was robbed of some of its splendor by the low mist, which blurred all outlines and refused to yield to the cold brilliance of the sunshine. But the significance of the meeting and the procession was more important than its appearance. Men in uniform watching the German ships come into view vied with one another in identifying them one by one, sometimes with the aid of books of silhouettes. But underneath the momentary excitement of determining whether this ship was the *Hindenburg* or the *Derfflinger* there was deep satisfaction that the tedious task of the navy had been fulfilled. There were one or

two little evidences of this which could not escape notice. For example, there was a certain finality in the hoisting at the peak of the *Queen Elizabeth* of the ensign flown by the *Lion* in the Jutland Battle. Part of the Union Jack had been shot away, and if the few Germans who could be seen on the decks of their ships troubled to scan the flag it must have aroused bitter thoughts in their minds. Again, the justifiable pleasure of the fleet in a work well done was shown unmistakably by the cheers from the ships of the northern line as they passed the stationary *Queen Elizabeth* on their way to harbor. From a dozen ships as they came abreast of the flagship, which had hoisted the blue pennant and drawn out of the line, there came the roar of full-throated cheers given in tribute, not only to Sir David Beatty personally but to the majestic living force whose destinies he controls.

A Tremendous Armada.—The other heavy ships of the Grand Fleet had left the flagship well behind when the German and British destroyers came out of the mist. In ordered array, flotilla on flotilla moved across the sea, the Germans completely encased by the British. So vast was the area they covered that both the head and the rear of the columns stretched away into the haze and were lost to sight. The eye could not count them. They were in themselves a tremendous armada. All this time the great captive fleet and the greater fleet which encircled it were moving slowly—almost at a funeral pace, and certainly not at the 12 knots stipulated by Admiral Meurer—towards the anchorage appointed for the Germans off May Island, the rocky island which stands in the middle of the Firth of Forth some miles eastward of the bridge. Presently the German ships came to rest, and it was seen that on every side of them were their British warders. Then the main body of the Grand Fleet made its way back to the stations from which it started in the early hours of the morning. As the *Queen Elizabeth* steamed along the lines to her mooring she was cheered again and again by the men who crowded the decks of the ships she leads. The day came to a peculiarly fitting close.

German Flag Hauled Down.—About an hour before noon the Commander-in-Chief issued the following signal to the fleet, and it was received beyond doubt by the Germans:

"**The German flag will be hauled down at sunset to-day (Thursday) and will not be hoisted again without permission.**"

The German ships, I should explain, were flying the German naval flag at the main. At 4 o'clock all hands in the *Queen Elizabeth* were piped aft. They had assembled, and were waiting perhaps for a speech, when suddenly the bugle rang out "making sunset." Instantly all turned to the flag and saluted. The next minute cheers for the Commander-in-Chief were called for. and given with deafening heartiness. Admiral Beatty acknowledged the tribute with a "Thank you" and added: "I always told you they would have to come out." Then the ship's company went back to their duties. In the meantime the Germans in the 71 ships which lay out of sight in the mist had undergone the mortification of seeing their flag hauled down, perhaps never to be hoisted again.

To-morrow, I understand, those ships will set out under a strong escort for Scapa Flow, to remain there until the Peace Treaty decides their fate.

I bring this dispatch to an end with a signal and a message issued by the Commander-in-Chief to every ship in the fleet to-day. The signal was this:

"It is my intention to hold a service of thanksgiving at 18.00 (six p. m.) to-day (Thursday) for the victory which Almighty God has vouchsafed to H. M. arms and every ship is recommended to do the same."

The message was as follows:

"I wish to express to the flag officers, captains, officers, and men of the Grand Fleet my congratulations on the victory which has been gained over the sea power of our enemy. The greatness of this achievement is in no way lessened by the fact that the final episode did not take the

form of a fleet action. Although deprived of this opportunity which we had so long and eagerly awaited and of striking the final blow for the freedom of the world we may derive satisfaction from the singular tribute which the enemy has accorded to the Grand Fleet. Without joining us in action he has given testimony to the prestige and efficiency of the fleet without parallel in history, and it is to be remembered that this testimony has been accorded to us by those who were in the best position to judge. I desire to express my thanks and appreciation to all who have assisted me in maintaining the fleet in instant readiness for action, and who have borne the arduous and exacting labors which have been necessary for the perfecting of the efficiency which has accomplished so much."—*London Times, 22/12.*

MAJOR UNITS OF THE SURRENDERED GERMAN FLEET

	Displacement	Speed	Best armor	Guns	Date of completion
Dreadnoughts					
Bayern	28,000 tons	22.5 knots	14-inch	8–15"; 16–5.9"; 12–3 4"	1917
Koenig	25,800 tons	22 knots	13¾-inch	10–12"; 14–5.9"; 10–3.4"	1914
Grosser Kurfuerst	25,800 tons	22 knots	13¾-inch	10–12"; 14–5.9"; 10–3.4"	1915
Markgraf	25,800 tons	22 knots	13¾-inch	10–12"; 14–5.9"; 10–3.4"	1915
Kronprinz Wilhelm	25,800 tons	22 knots	13¾-inch	10–12"; 14–5.9"; 10–3.4"	1915
Kaiser	24,500 tons	23 knots	13¾-inch	10–12"; 14–5.9"; 12–3.4"	1912
Kaiserin	24,500 tons	23 knots	13¾-inch	10–12"; 14–5.9"; 12–3.4"	1913
Koenig Albert	24,500 tons	23 knots	13¾-inch	10–12"; 14–5.9"; 12–3.4"	1913
Friederich der Grosse	24,500 tons	23 knots	13¾-inch	10–12"; 14–5.9"; 12–3.4"	1913
P. Regent Luitpold	24,500 tons	23 knots	13¾-inch	10–12"; 14–5.9"; 12–3.4"	1913
Battle Cruisers					
Hindenburg	27,500 tons	28 knots	12-inch	8–12"; 12–5.9"; 12–3.4"	1916
Derfflinger	26,500 tons	27 knots	12-inch	8–12"; 12–5.9"; 12–3.4"	1914
Seydlitz	25,000 tons	28 knots	11-inch	10–11"; 12–5.9"; 12–3.4"	1913
Moltke	23,000 tons	28 knots	11-inch	10–11"; 12–5.9"; 12–3.4"	1912
Von der Tann	20,000 tons	27 knots	9-inch	8–11"; 10–5.9"; 16–3.4"	1910
Scout Cruisers					
Bremse	4,100 tons	35 knots	....	4–5.9"; 8–4.1"	1918
Brummer	4,100 tons	35 knots	....	4–5.9"; 8–4.1"	1918
Emden	5,400 tons	30 knots	....	10–5.9"; 4 anti-aircraft	1916–17
Karlsruhe	5,400 tons	30 knots	....	10–5.9"; 4 anti-aircraft	1916–17
Nurnberg	5,400 tons	30 knots	....	10–5.9"; 4 anti-aircraft	1916–17
Frankfort	5,400 tons	30 knots	....	10–5.9"; 4 anti-aircraft	1916–17
Koln	6,300 tons	33 knots	....	2–8.2"; 6–5.9"	1916–17
Koenigsberg	5,400 tons	30 knots	....	10–5.9"; 4 anti-aircraft	1916–17

U-BOATS DESTROYED BY ALLIES.—It is announced from London that approximately 200 German submarines were destroyed during the course of the war. The total number of all types built by the Germans is estimated to have been 360.—*Nautical Gazette, 7/12.*

MINE-SWEEPERS TO CLEAR GERMAN BASES OF MINES.—A fleet of mine-sweepers left the Firth of Forth this morning on their way to Kiel and Wilhelmshaven to clear the channels and disarm the remnants of the German Navy. It consists of the Hunt class of sweepers, and comprises the *Musketry* (flagship), *Cottesmore, Cotswold, Pytchley, Holderness, Tamworth, Garts,* and *Maythorp.*

The vessels will proceed to Copenhagen and will make a passage through Elsinore Sound and the Baltic to Kiel Bay for the bigger ships, which will follow later in the week.

The latter forces will consist of the battleship *Hercules* and ten destroyers, and it will be the duty of Admiral Montagu E. Browning, who will

be in command, to ascertain if the remaining German vessels at the bases of Kiel and Wilhelmshaven are properly disarmed.

A tenth German dreadnought remains to be turned over by Germany, and another destroyer has been demanded in place of the one which was sunk by a mine on the passage across the North Sea.—*N. Y. Times*, 26/11.

SPEED OF THE GERMAN FLEET.—*Lack of Lubricating Oil.*—It is stated that the limitation of the speed of the German Fleet to 12 knots (in actual fact it was not more than 10) was due to lack of lubricating oil and the fear that a higher speed would cause a breakdown of the engines.—*London Times*, 23/11.

THE LOST DESTROYER.—It is established beyond doubt that the German destroyer which was lost on her way across the North Sea on Thursday was sunk by a mine. The bulk of those on board were rescued, but a few were killed or injured as the result of the explosion.—*London Times*, 23/11.

BLACK SEA FLEET.—The following are the ships composing the Black Sea Fleet which was in German hands:

Dreadnought Battleships.—*Volya, Demokratiya* (building at Nicolaev), *Imperatritsa Maria* (raised but not repaired).

Pre-Dreadnought Battleships.—*Evstafi, Ioann, Zlatoust, Borets Za Svobodu, Sinap, Tri Svyatitelya, Rostislav.*

Cruisers.—*Pamyat Merkuriya, Ochakov, Almas* (converted to seaplane carrier).

Light Cruisers (building at Nicolaev).—*Admiral Nakkimov* (almost complete, May, 1918), *Admiral Lazarev, Admiral Kornilov, Admiral Istomin* (last two unlaunched).

DESTROYERS

Old Boats.—*Tcerigo, Jante, Corfu, Lefkos, Schastlivi, Gromki, Buistri, Puilki, Pospyeshni, Bespokoini, Derzki.*

Older T. B. Ds.—*Kapt. Saken, Zhivoi, Zharki, Zhutki, Zvonki, Zorki, Zavidni, Zavyetni, Strogi, Sviryepi.*

Submarines.—*Buryevyestnik, Lebed, Pelican, Orlan, Utka, Gagora, Krab* (minelayer), *Nerpa, Tyulen, Kashalot, Kit, Narval.*—*Army and Navy Gazette*, 9/11.

TWO GERMAN BATTLESHIPS DISARMED.—The German battleship *König* and the battle cruiser *Mackensen*, which, although scheduled for surrender Nov. 21, were permitted to be absent, are being disarmed under the supervision of Vice Admiral Browning of the British Navy, who was sent to Germany for that purpose, according to the correspondent of the London *Daily Mail* with the British Fleet. The *König* has been in dock and could not be moved, while the *Mackensen* had not been completed.—*Army and Navy Journal*, 30/11.

NAVAL WAR NOTES.—*Surrender of More German Submarines.*—In addition to the German submarines previously surrendered in British waters under the terms of the armistice, 20 more were surrendered on Nov. 22 to Admiral Sir Reginald Tyrwhitt, of the British Navy, off Harwich, England. One submarine sank during the night, and but for this disaster the number surrendered would have been 21. A surrender of 28 more German submarines took place on Nov. 24 at Harwich in the presence of Sir Eric Geddes, First Lord of Admiralty, and 27 additional were surrendered at Harwich, Nov. 27. These surrenders make a total of 114 German submarines turned over to the British Navy. Those last surrendered, according to the *Associated Press*, included several very

large submarines and four of the cruiser type, one being nearly 350 feet in length. The submarine *Deutschland U-153* was among the number. She had aboard Lieuts. Julius H. Fulcher and Frank L. Muller, U. S. N., who had been picked up by the submarine after the American cargo ship *Ticonderoga* was torpedoed on Sept. 30 last. The officers were taken to Kiel by the *Deutschland*, which was returning from a three months' cruise in American waters, and were landed Nov. 24 at Harwich. Another submarine surrendered was the *U-139*, commanded by Lieut. Commander Arnauld T. La Perriere, who in 1916 was awarded the Order Pour le Merite for sinking 126 vessels.—*Army and Navy Journal*, 30/11.

GERMAN DESTROYER MINED.—An Edinburgh message states that one of the German destroyers was mined on the way across the North Sea.—*London Times*, 12/11.

GERMANS BUILDING CRAFT TO FLY ACROSS ATLANTIC.—The Germans are building an airplane with which they intend trying a trip across the Atlantic and have a Zeppelin under construction with the same idea in view, according to the correspondent at Berlin of the *Daily Express*. The correspondent says he learned this when being shown over an aircraft factory at Staaken, a suburb of Berlin by Managing Director Raasch, a former naval officer.

The Staaken works built during the war cover hundreds of acres and employ 3000 workers. The machines employed in the later raids on London and Paris were built there. The machine being constructed there for the transatlantic flight, says the correspondent, has a wing spread of 198 feet and engines of 3000 horsepower.

Almost immediately after the armistice was signed the Staaken plant began converting the fighting planes on hand into commercial machines intended to link all the European capitals with Berlin, and dozens of planes built entirely of aluminum are being transformed for postal service.

The correspondent says he has learned that the Zeppelin factory at Friedrichshafen is building an airship for a transatlantic voyage, capable of carrying 100 passengers. It has nine engines and eight propellers. Its first flight will be in July next, if the international situation clears up by that time. The trip is expected to be made in 40 hours.

The correspondent was told of the remarkable flight of a Zeppelin in November, 1917. The airship started from Bulgaria for East Africa, with 22 tons of munitions and medicines and a crew of 22. It had arrived over Khartoum in the Sudan, the correspondent's information declared, when it was ordered by wireless to return because it was learned that the bulk of the forces of Gen. von Lettaw-Vorbeck, the German commander in East Africa, had surrendered. It returned to its starting point four days after it had left.

Director Raasch claimed that this airship could have gone from Berlin to New York and back without stopping—*Baltimore American*, 7/12.

NORTH GERMAN LLOYD'S YEAR-BOOK.—The year-book of the North German Lloyd publishes a statement concerning the seizure of German ships in oversea countries since the entry of the United States and its allies into the war. In the United States a total of 115 German and Austro-Hungarian ships, with a tonnage of 703,792 tons, was expropriated. The chief sufferers were the Hamburg-Amerika and the North German Lloyd, the former losing 35 ships, with 283,122 tons, and the latter 29 ships with 234,056 tons. The North German Lloyd lost, in addition, in Brazil, Peru, Siam, and China, 75,000 tons; and the same company had already lost about 60,000 tons in Italian and Portuguese harbors. On January 1, 1917, the fleet of the North German Lloyd represented 983,000 gross tons.—*Nautical Gazette*, 16/1.

GREAT BRITAIN

ZEEBRUGGE VISITED.—*Skill of British Naval Gunners.*—A correspondent describes a visit to Zeebrugge since its evacuation by the Germans. He entered the harbor in the early hours of the morning. Along all the length of the great mole, upon which the men of the *Vindictive* surged ashore from her plunging gangways, nothing moved; it stood like a monument—a vast memorial to the dead and the living who made it glorious and unforgettable.

At Zeebrugge there is no population at all; the last civilians were evacuated in June, "when," said one of them at Blankenberghe, "it began to rain bombs." The village stands a little apart and to the east of the port, and is only superficially damaged. Such has been the accuracy and discrimination of our bombardments, both from the sea and the air, that all along the coast private property had received surprisingly little injury, and many prominent and responsible Belgians have expressed to our naval authorities their appreciation of the fine skill and humanity with which our fire was limited to purely military targets. At places beyond the range of the naval guns, such as Bruges, the line of demarcation between private property and such military targets as the docks was drawn with remarkable precision; the air forces which carried out the incessant night and day bombing operations have sedulously endeavored to avoid, and wonderfully succeeded in sparing, the fine old city. Dunkirk, bombed by the Germans during four years, stands in strong contrast to this evidence of respect for the laws of civilized war; there the damage to houses, to churches, and so forth, and to life is general all over the town.

The last Germans, doubtless those charged with constructing the "booby-traps" of which the place is a tangle, seem to have left late on the night of Saturday, the 19th. They blew up the temporary bridge which covered the gap in the jetty at the landward end of the mole, set adjacent buildings on fire, and cycled towards Bruges. Our motor-launches are working at the entrance to the harbor, clearing it of mines; the rattle of their machine-guns is incessant, and at intervals comes the great leap of water and smoke followed by the stunning detonation, the signal that a mine has been touched off.

The exploration of the mole has commenced. It will be a long task, and not alone because of the length of the structure and the great number of sheds and buildings, and the great quantity of material with which it is covered. Experts are required in that new science which German war methods have forced upon the world—the science of neutralizing "booby-traps." There are wires everywhere; they run in and out of the *débris* which strews the place; they even snake in and out of the strands of coiled wire hawsers. It is dangerous to tread anywhere or to touch anything. Some such traps were laid at Blankenberghe, in the abandoned huts by the dunes, and children have been killed by them.

The Gutted "Block" Ships.—The "block" ships, *Intrepid* and *Iphigenia,* lie well within the piers, the latter across the passage, the other at a slight angle to the piers. *Thetis* is outside, but well across. The German torpedo-boats could only be maneuvered past them with the greatest difficulty after extensive dredging operations had been carried out. All that remained in the old ships that could be unscrewed, unbolted, or cut away has been removed. There remains not a scrap of brass or copper. Round *Iphigenia's* conning-tower a bomb-proof shelter of reinforced concrete has been erected as a refuge for the men at work on the dredger during our air raids.

But those who gutted the old ship so thoroughly to obtain metal for their munition factories were, at the last, in such haste to leave that they abandoned guns ashore and on the Mole which had riddled the old *Vindictive,* as well as several anti-aircraft cannon. On Wednesday, the 23d, six months to the day since she steamed into the harbor in face of the

frantic fire, the white ensign was hoisted aboard of the *Thetis;* it flies there yet.

Eastward of Zeebrugge lies Heyst, and then comes the Dutch frontier, with its triple wire fence and the neat huts of the guards. It is all ours, the spoil of the unresting navy which, for four years, has maintained its tireless war upon this vital and dangerous front. The coast is clear. Already there are lights along it, where none have shown since August of 1914.—*London Times,* 30/10.

WARSHIP MINED.—The British warship, *Cassandra* has been mined in the Baltic, it was announced to-day.

The name *Cassandra* does not appear in any available British naval lists. —*Baltimore Evening Sun,* 7/12.

BRITISH SQUADRON GOES TO KIEL.—The British squadron which will go to Kiel and Wilmhelmshaven it is understood in naval circles, will be commanded by Vice Admiral Montagu Browning, who will be accompanied by American, French and Italian admirals. The purpose of the journey is to see that German vessels in those ports are properly disarmed and interned. A flotilla of British mine-sweepers left the Firth of Forth, Scotland, Nov. 25 to clear the passage to Kiel for the squadron.—*Army and Navy Journal,* 30/11.

BLEW UP U-BOAT IN THE TAY.—Details of how an attempt by a German submarine to blow up the bridge over the Tay at Dundee some time ago was frustrated are published by *The Dundee Advertiser.* A British airman observed a large submarine lying on the sandy bottom of the river near Dundee.

An alarm was immediately given, and numerous mine sweepers and destroyers were soon in the vicinity. The wire ropes of the sweepers struck their mark and a depth charge was lowered. A patrol boat then dropped a very heavy charge, which exploded with tremendous force. Oil and wreckage came to the surface, and divers afterward found 13 dead German sailors.

Two guns and a large part of the wreckage salved are now on exhibition in Dundee.—*N. Y. Times,* 30/11.

BRITISH WARSHIPS ARRIVE AT LIBAU.—*Fleet That Entered the Baltic with Transports Now on Courland Coast.*—A British fleet arrived yesterday at the port of Libau, in Courland, on the Baltic, says a Wolff Bureau dispatch from Berlin to-day.

[Advices received in London on Nov. 28 from Copenhagen reported two British squadrons off the east coast of Denmark headed south. They numbered 22 ships, including destroyers, cruisers, mine-sweepers, and transport steamers.]

If a few British torpedo-boats or light cruisers, with even a small landing force, could reach Reval this week they could dam the Bolshevist flood which has been murdering, burning and plundering Esthonia and Livonia, according to a declaration made to the correspondent by Baron Aexkuell of Esthonia, who escaped from that country on Thursday in disguise.

Baron Aexkuell reports that German forces had begun to evacuate Narva, when they were attacked and defeated by Russian troops.

Last Tuesday White Guards, commanded by former Russian officers, under the leadership of Count Keller of the old Russian régime, were attacked by a superior Bolshevist force. The Guards gave protection a month ago to 500 Russians, who alleged they had deserted from the Bolshevist army because of bad treatment. They brought 23 machine guns with them. While the attack was proceeding last Tuesday these

Russians fired upon the White Guards from the rear, contributing materially to their defeat. The White Guards, half annihilated, retired.

Esthonian workmen are nearly all Bolsheviki, according to Baron Aexkuell, and the middle classes of Esthonia and Livonia are facing the same reign of terror that the bourgeoisie of Russia have suffered.—*N. Y. Times*, 4/12.

BRITISH NAVAL CASUALTIES.—The British Admiralty announced on Nov. 26 that the British naval casualties from the outbreak of the war until Nov. 11 numbered 39,766. These were divided as follows: Killed or died of wounds—officers, 2466; men, 30,895. Wounded, missing or prisoners—officers, 1042; men, 5363. In addition, 14,661 officers and men of British merchant vessels and fishing boats lost their lives while pursuing their ordinary vocation by enemy action and 3295 were taken prisoner.—*Army and Navy Journal*, 30/11.

CHANGES IN NAVAL TITLES.—The Admiralty announces that the recent changes in the titles of officers of the medical, accountant and naval instructor branches of the Royal Navy are applicable to officers on the retired and emergency lists, who have actually served during the war.

The changes in titles referred to above are as follows:

Medical Branch.—Surgeon General to be Surgeon Rear Admiral; Deputy Surgeon General to be Surgeon Captain; Fleet Surgeon to be Surgeon Commander; Staff Surgeon to be Surgeon Lieutenant Commander; Surgeon to be Surgeon Lieutenant; Surgeon Probationer to be Surgeon Sub-Lieutenant, R. N. V. R.

Accountant Branch.—Paymaster General to be Paymaster Rear Admiral; Paymaster-in-Chief to be Paymaster Captain; Fleet Paymaster to be Paymaster Commander; Staff Paymaster to be Paymaster Lieutenant Commander; Paymaster to be Paymaster Lieutenant; Assistant Paymaster to be Paymaster Sub-Lieutenant; Clerk to be Paymaster Midshipman.

Naval Instructor Branch.—Chief Naval Instructor to be Instructor Captain; Naval Instructor (with 16 years' seniority) to be Instructor Commander; Naval Instructor (with eight years' and less than 16 years' seniority) to be Instructor Lieutenant Commander; Naval Instructor (with less than eight years' seniority) to be Instructor Lieutenant.—*Army and Navy Gazette*, 23/11.

FIFTY-SEVEN HOURS UNDER WATER.—Of the many thrilling stories which might be told of naval heroism during the war, few, if any, can rival that of a British submarine which went down in Gareloch, near the Clyde. The story has in part already been told, as it related to the act for which the late Captain Goodhart, D. S. O., was posthumously awarded the Albert Medal in gold, as announced in *The Times* on the 24th of last April.

The submarine was on her trials. She had on board 73 persons, including naval contractors and men from the yard where she had been built. The order was given for her to submerge, and when she had just gone beneath the surface water began to pour into her aft, and she descended stern downwards into 15 fathoms. The ventilating shafts had been accidentally left open. Those in the rear of the submarine, 31 in number, were immediately drowned. The forepart of the vessel was shut off, and the 42 who were at that end were saved. How their rescue was accomplished is a tribute to the skill of the Admiralty Salvage Department.

A few hours had passed before divers went down to the submarine on what they considered a forlorn hope. Getting to the bottom, they discovered that the stern of the vessel was embedded in many feet of mud. They knocked at the hull, and to their amazement there was a responsive tapping, showing that some at least of those inside were alive. Then

Captain Goodhart essayed the task which cost him his life. The high-pressure air bottles were brought into use, and the captain undertook, with their aid, to be projected through the conning-tower and shot into the water in the hope of reaching the surface and conveying to the rescue party information as to the condition of those below. He was hurled upward at terrific speed, but his head struck a support in the tower, and he was immediately killed. His example was followed by another ship's commander on board, who was fortunate enough to reach the surface and was caught and saved by the salvage men.

Cards "to Beguile the Tedium."—Acting on his information, divers again descended and got into communication with the imprisoned men by means of Morse signals. With great ingenuity the rescuers were able to insert through a water flap, which was temporarily opened from the inside, a flexible hose, through which air and also Bovril, chocolate, and other sustaining food was passed. The entombed men never lost heart, although the chances were that they would never be got out alive. At their request playing cards were sent down "to beguile the tedium of waiting," as one of them said. Strong wires were put round the vessel, and as the submerged men were provided with air from above there was no need for them further to conserve their air bottles. These they utilized to blow out the oil fuel stowed forward. With this gone, the vessel after a time drove upwards at high speed until her bow was well above water in a perpendicular position. Immediately a big hole was made in her by acetylene burners, and the 42 men were brought out and conveyed to an infirmary nearby.

It was about midnight when the submarine rose, and in the glare of the arc lights of the salvage ships they walked, or were carried, to the infirmary amid the cheers of scores of men who had been aiding them to escape death. The submarine spat out fire and smoke, and the last man had not been long rescued before the vessel settled down and slid again to the depths of the loch. The submarine had been below about 24 hours when Captain Goodhart made his ill-fated attempt, and altogether the party were down 57 hours before they were so miraculously saved.—*London Times*, 21/11.

ITALY

ITALIAN SEA TANK.—The operations of the Italian Navy will hold a conspicuous place in the annals of the Great War. The major units of their fleet (battleships, cruisers), have had little if any opportunity for battle; but this was not the fault of the Italian command; it was due to the unwillingness of the Austrians to come out of their fortified harbors and risk a fight in the open—a reluctance that was shared by their German ally.

So what engagements took place were confined to the smaller craft, light cruisers, destroyers, motor-boats and submarines, and in these branches of the service the Italians have shown admirable initiative, great skill, and unquestioned daring. Not only have they made constant use of the established types of craft, but they have developed new types that have scored some of the most brilliant successes of the war.

The attack of two torpedo motor-boats upon three Austrian dreadnoughts of the *Viribus Unitis* type, while they were defended by a screen of destroyers, in which two of the dreadnoughts were sunk, was the most daring and successful feat of its kind in modern naval history.

Commander Luigi Rizzo was in command at the time. This feat is in the same class as the successful night attack on Pola, when another battleship was torpedoed. The Pola success was attained by the use of a boat which had been designed for this very kind of work. Its characteristics are shown in the accompanying drawing, from which it will be seen that the hull is of the "sea-sled" type, with a tractor device to enable it to climb over the torpedo-defence boom, with which the harbor was closed.

On each side of the boat is an endless chain belt, provided with projecting prongs or teeth, which engages suitable sprocket wheels and the ends of the boat. These wheels are carried on brackets at bow and stern, the latter projecting far enough beyond the covering board to protect the rudder and propeller from contact with obstructions crossed by the boat. The tractor belt travels under the bilges of the boat and returns within the hull, as shown.

On meeting an obstruction the belt is started; and first the bow and then the body of the back is lifted across the boom. On each side, a 14-inch torpedo is mounted on two shelves or brackets and held in place by a hinged strap. When the strap is released the engine is started and the torpedo falls into the water; being steered to its mark by the gyroscopic steering gear.—*Scientific American*, 23/11.

THE ITALIAN SEA TANK MOUNTING A TORPEDO-DEFENCE BOOM IN AN ATTACK ON A FORTIFIED HARBOR.

RUSSIA

RED GUNBOATS RETIRE AS ICE BLOCKS DVINA.—Winter has begun in earnest over the whole Northern Russian front. All the rivers are ice-bound and the Bolshevist gunboats, which have long menaced the American and allied forces on the Dvina, have been forced to withdraw to escape being frozen in. The Bolsheviki, however, have mounted big guns along the front south of the allied armies.

Operations are limited to spasmodic artillery exchanges, but the Bolshevist forces are reported to be receiving heavy reinforcements. The free-up, while bringing relief on the Dvina front, increases the danger on others, as the once-impassable swamps are now frozen, making possible bushwhacking flank attacks by the enemy.

The correspondent has just returned from a trip along the front, where he found a general reversal of the opinion that the Bolsheviki would not fight. Near Kadish, a fortnight ago, a body of Bolshevist infantry maintained an advance against strong machine-gun fire. A Russian resident, in talking with American soldiers regarding this attack, said the Bolshevist officers threatened their men that they would be killed the next day if they failed to advance.

The cold is so intense in some sectors of the front that the Americans sleep with their machine guns rolled in the blankets with them to prevent the water-cooling chambers of the guns from freezing.—*N. Y. Times*, 27/11.

TURKEY

ALLIED VESSELS IN BLACK SEA.—The Bosporus having been cleared of mines allied warships have entered the Black Sea and visited various ports from Varna around the southern coast to Novorossysk. Dredging operations in the Bosporus were completed on November 20. French and other allied warships were detached from the naval forces station at Constantinople and visited the Black Sea ports of Varna, Galata, Eregi, Samsun, Sinope, Trebizond, Batum, Poti and Novorossysk. The British, French and Italian warships made quite a formidable force. It numbered 50 ships comprising battleships, cruisers and destroyers.—*American Journal*, 30/11.

UNITED STATES

BUILDING

ONE SUPER-DREADNOUGHT SOON WILL BE LAUNCHED.—With the lifting of the voluntary censorship it now is permissible to reveal that one of the great super-dreadnoughts authorized in the 1916 three-year building program is well advanced in construction at the plant of the Newport News Shipbuilding and Dry Dock Company.

The keel of the 33,000-ton battleship was laid after the country went to war, and, in spite of the call made on this yard for 32 destroyers to fight the submarine, work on the big vessel has progressed satisfactorily. The hull has taken shape and probably will be ready for launching within a few months.

This monster man-o'-war will mount eight 16-inch rifles in four turrets on the center line, two forward and two aft, and naval officials believe that she will be the equal if not the superior of any warship afloat. Four of these ships were authorized and another is to be built here and two by the Fore River Shipbuilding Company at Quincy, Mass.—*Washington Evening Star*, 29/11.

NAVY'S NEWEST WORLD'S BIGGEST SEAPLANE CARRIES 50 PASSENGERS IN TEST FLIGHT.—Secretary Daniels authorizes the following:

All records for the number of passengers carried in any type of airplane were broken on Wednesday, November 27, at the Naval Air Station, Rockaway, when the navy's newest type seaplane, the giant *NC-1*, the largest seaplane in the world, made a flight with 50 men on board.

The pilot was Lieut. David H. McCullough, of the Naval Reserve Flying Corps, and the flight was made to demonstrate the enormous lifting power of the latest model of bomb-carrying seaplanes. No special modifications were made for this test flight, most of the 50 men being accommodated in the large boat body.

Seaplane of Special Type.—The design and the construction of the *NC-1*, with its triple motors, huge size, and other distinctive features, was carried out by the navy in cooperation with the Curtiss Engineering Corporation. It is not specifically a flying boat nor is it of the pontoon variety of seaplane, but combines the most valuable advantages of both, its size and purpose being considered. While it is entirely new and original in type, the *NC-1* incorporates proven essentials in aircraft construction and even before it was tested was regarded in naval circles as a preinsured success rather than as an experiment.

This is the first American trimotored seaplane, being propelled by three Liberty motors that develop a maximum of 1200 horsepower, giving it a cruising speed of 80 miles an hour. The flying weight of the machine is 22,000 pounds, while the weight of the seaplane itself, unloaded and without a crew, is 13,000 pounds.

Wing Spread, 126 Feet.—An idea of the size of the big seaplane is shown by the fact that the wing spread is 126 feet, the breadth of wing 12 feet, and the gap between wings 12 feet.

Recently the *NC-1* made the trip from Rockaway to Washington, about 350 miles, in 5 hours and 20 minutes. The flight from Washington to Hampton Roads, 150 miles, was covered in 2 hours and 15 minutes, and the trip from Hampton Roads to New York, 300 miles, took 4 hours and 20 minutes.—*Official Bulletin*, 2/12.

EXTENSION OF NAVAL STATIONS.—The President's proclamation takes title to lands for navy at Great Lakes and Puget Sound, and site for marine corps at Quantico.—*Official Bulletin*, 15/11.

NAVY YARD EXPANSION RAPID, ON LARGE SCALE.—Expenditures totaling $193,164,458 were made during the fiscal year 1918 for work performed by the naval bureau of yards and docks in preparing for and prosecuting the great world war.

Rear Admiral C. W. Parks, chief of the bureau, says in his annual report that a large part of the bureau's activities during the year pertained to improving and equipping navy yards for the construction of ships and in supervising the extension and improvement of 36 private plants to which financial aid was given by the government.

In some cases, he says, the navy will own these private plants and in others the owners will take the plants back at an appraised value. Naval training camps were established at 39 different places at a cost of $45,437,000, exclusive of hospitals. These camps will provide winter quarters for 164,875 men.

Extensive improvements were made at the various naval ammunition depots and magazines. At St. Julien's Creek, Va., a temporary mine-filling plant was installed at a cost of $525,000. Chief Parks says that a very large expansion took place at the Washington Navy Yard and the capacity of the ordnance plant was largely increased. That work cost approximately $6,000,000.

The program to quadruple the powder output at Indian Head, Md., Admiral Parks says, involves very extensive public works improvements. Plans and specifications were prepared for approximately $3,500,000 worth of improvements and contracts placed. To facilitate transportation of the enormous quantities of materials required, a 13-mile railroad connection to the Pennsylvania railroad line is being constructed.

During the year 735 contracts for public works were awarded for amounts aggregating $84,700,000. A very large amount of money was saved, says Admiral Parks, by purchasing material at government prices and turning the same over to the contractors to be worked into place. Notwithstanding war conditions, says he, the pre-war navy standard of materials, inspection and workmanship was well maintained.—*Washington Evening Star*, 12/12.

CUTS EAGLE BOAT ORDER.—The Navy Department has directed that only 60 out of the 112 eagle boats ordered from Henry Ford shall be completed, the House Naval Affairs Committee was informed to-day.

Until recently the navy had planned to complete the entire eagle boat program, despite signing of the armistice.—*Baltimore Evening Sun*, 7/12.

"FORDS" AT SUBMARINE BASE.—The first three Ford eagles to be built for the United States Navy, numbered 1, 2 and 3, have arrived at the submarine base here after a long trip through the St. Lawrence River, down the eastern coast and through the Cape Cod Canal.

Three other eagles are said to be ice-bound in the Great Lakes. The eagles 1, 2 and 3 are on their way to China under their own power.—*Evening Star*, 18/12.

PROGRESS OF BUILDING PROGRAM.—The American Navy will number a total of 1291 vessels, including 40 battleships and 329 destroyers, on July 1, 1920, according to a statement prepared by Rear Admiral Griffin, Chief of the

Bureau of Steam Engineering, for the House Naval Committee, and made public to-day.

This statement shows that when war was declared there were 364 ships in the navy, while on November 1, ten days before hostilities ceased, there were 777, exclusive of privately owned yachts and other vessels taken over for patrol service. The greatest increase was 300 in submarine chasers. The increase in destroyers was 41, to a total of 92, and that of submarines from 44 to 79.

Only two eagle boats had been completed on November 1. Ninety-eight others were contracted for, but Rear Admiral Taylor, Chief of the Bureau of Construction and Repair, has informed the committee, it became known to-day, that the Navy Department has given orders that only 60 of the vessels be completed. Keels for 80 of the eagles have not been laid, but material for most of them has been fabricated.

Only two battleships were added to the fleet during the war, and only one would be added between this time and July 1, 1920, Admiral Griffin said. Six others, however, actually are under construction, and two, the *Tennessee* and the *California*, are approximately half completed. Work on three others is yet to be started.

Admiral Taylor informed the committee that contracts were yet to be placed for 29 ships, which have been authorized. They include 2 battleships, 12 destroyers, 10 submarines, 2 destroyer tenders, a repair ship, a transport, and a submarine tender.

Work has not yet started on any of the five battle cruisers authorized in 1916, the laying down of these vessels and other major craft having been deferred because of the demand for destroyers during the war. Ninety-five destroyers authorized during the war now are more than half completed.—*New York Times*, 7/12.

POLICY

FROM THE PRESIDENT'S ADDRESS TO CONGRESS.—I take it for granted that the Congress will carry out the naval program which was undertaken before we entered the war. The Secretary of the Navy has submitted to your committees for authorization that part of the program which covers the building plans of the next three years. These plans have been prepared along the lines and in accordance with the policy which the Congress established, not under the exceptional conditions of the war, but with the intention of adhering to a definite method of development for the navy. I earnestly recommend the uninterrupted pursuit of that policy. It would clearly be unwise for us to attempt to adjust our programs to a future world policy as yet undetermined.—*Congressional Record*, 2/12.

THE SECRETARY'S RECOMMENDATION.—Secretary Daniels strongly urges the continued upbuilding of the navy, in accord with the policy adopted in 1916, by authorization of another three-year program, costing $600,000,000 and embracing 156 vessels, in his annual report, made public to-day.

"When the peace terms are signed and the agreement between all nations cements the blood-bought victory for permanent peace," the Secretary says, "the detailed story of the navy's participation will afford a new cause for gratification and give a greater thrill of pride when the world fully knows the many instances of splendid courage which could not be fully disclosed during the struggle and must be left for the historian to record."—*Washington Evening Star.*

THE NAVY BOARD'S RELIEF.—Rear Admiral Badger, chairman of the general board of the navy, said yesterday to the House Committee on Naval Affairs:

"The general board believes that under the present world conditions, and the conditions likely to obtain in the future, the United States Navy should steadily continue to increase. Ultimately it should be equal to the most powerful maintained by any other nation in the world. Year by year development should be made as consistent with the facilities of the country, but the limit above defined should be attained not later than 1925."

A few years ago a deliverance of this tenor from such a source would have been received with derision by all Little Navalites. They would have characterized it as grounded in mere selfishness. We should have been told that here was an effort to increase the size of the navy in order to increase the number of "fat" berths and the pay of all in the naval service. Moreover, we should have been warned that a larger navy would mean a keen "hunt for trouble," and that trouble would be found. And it was such talk that bore a part in the starving of the navy for a long period—too long for the country's good.

We shall hear little, if anything, of such talk to-day. The navy has just demonstrated its value and importance. Hastily increased in size for war purposes, it performed its part in the war so as to merit and receive high praise both at home and abroad. Secretary Daniels, in his annual report to Congress, has just voiced home sentiment, while Viscount Grey, in a public speech, has just voiced British sentiment. He expressed to an English audience night before last "great appreciation of American assistance in the war," and declared that without that assistance on the sea the Allies could not have won.

In the matter of the navy, therefore, Congress has now before it the recommendation of the President, that of Secretary Daniels, that of the general board of the navy, and can consider at its proper value the testimony of this English statesman, who, though not in office now, was in office when the war began, and has kept close track of all war performances by his own as well as by other countries.

The result should not be in doubt. What is asked for the navy Congress should grant. The war has committed us to large expenditures for some years to come; and none will be better approved by the people than those in the interests of equipping us with a thoroughly adequate sea power in both of the great oceans. In a word, the American Navy, for American purposes, should be the largest in the world.—*Washington Evening Star*, 13/12.

MATÉRIEL

RECORD OF NOTABLE ACHIEVEMENTS.—The report of the Secretary of the Navy to Congress tells of achievements in ordnance, especially the notable work of the 14-inch naval guns on railway mounts on the western front, which hurled shells far behind the German lines, these mounts being designed and completed in four months.

An account is given of the mine barrage in the North Sea, one of the outstanding anti-submarine offensive projects of the year, thus closing the North Sea. A special mine-loading plant, with a capacity of more than 1000 mines a day, was established by the Navy Department. A star shell was developed which when fired in the vicinity of an enemy fleet will light it up, make ships visible and render it an easy target, without disclosing the position of our own ships at night. The bureau of ordnance, under the direction of Rear Admiral Earle, is stated to have met and conquered the critical shortage of high explosives which threatened greatly to prolong the time of preparation necessary for America to smash the German military forces.

The work of the bureau in completing a successful Davis non-recoil aircraft gun is declared to be "a great milestone in aircraft armament," and there is given an account of a heavy aeroplane bomb developed for anti-submarine warfare, and the protection of merchant ships by increased

armament, naval gun production being stated to have kept pace with war needs, while the smokeless powder output was increased. In the future, it is stated, American dreadnoughts and battle cruisers will be armed with a 16-inch gun, making these the heaviest armed vessels in the world. Depth charges are stated to be the most effective anti-submarine weapon, and American vessels were adequately armed with that new weapon.

Great strides in torpedo production have been made. A new long-range proving ground on the Potomac, near Machodoc Creek, Va., has been acquired. Training in gunnery and engineering has been carried out with eminent success.

"The navy that flies" is given special reference, it being stated that the expansion of naval aviation has been of gratifying proportions and effectiveness, many air stations being established at home and abroad. Naval aircraft has been a big factor in the war, and "aircraft has come to stay," says Secretary Daniels, who plans for its permanency and development.

	Officers and men detailed to flight duty	Hours flight for year
1911	4	47
1912	9	150
1913	10	575
1914	13	252
1915	30	2756
1916	50	1385
1917	600	11,109
1918 (Nov. 4)	4729	37,855

When war was declared the navy numbered 65,777 men. On the day Germany signed the armistice this had increased to 497,030 men and women. Referring to the excellent work done by the women who enlisted, the Secretary says: "A woman who works as well as a man ought to receive the same pay, and that policy has been carried out by the navy."

When war was declared there were 197 ships in commission, now there are 2003 vessels in service, and they have been furnished with trained officers and men, "and how fit they were all the world attests." The value of the Naval Reserve is emphasized and the evolution which brought this into being as an essential part of the navy is recounted. From a small enrollment when the war broke out, this grew to 85,473 by April, 1918, and now numbers about 290,000.

In reference to the three-year building program, Secretary Daniels says:

"The day is not far distant when the world will witness an end of competitive building between nations of mighty weapons of war. In the peace treaty there will undoubtedly be incorporated President Wilson's proposal for a reduction of armament 'to the lowest point consistent with domestic safety.'

"Navies will still be needed as an international police force to compel compliance with the decree of an international tribunal which will be set up to decide differences between nations. Naval vessels will have large peace tasks of survey and discovery and protection in addition to police duty of an international as well as of a national character.

"Inasmuch as the United States is the richest of the great nations, and has suffered less in war than any of the allied powers, it will devolve upon this country to make a contribution to the navy to preserve the peace of the world commensurate with its wealth, its commerce, its growing and expanding merchant marine, and its leadership in the council of free people. It is therefore our duty now, not, indeed, to enter upon any new and ambitious naval program, but to go forward steadily upon the lines of naval increase to which the country committed itself by the adoption three years ago of the first far-reaching constructive naval program in the history of the republic.

"I have recommended to this Congress the adoption of another three-year program substantially like the one authorized in 1916. But the victory of the Allies and the United States should, and will, I sincerely trust within a few years make it no longer necessary for any nation under whip and spur to burden its taxpayers to undertake to build, in competitive construction, bigger fighting ships and more of them than any other nation can construct."

Recital of Accomplishments.—As concrete evidence of what was accomplished, the report shows that on October 1, there were 338 United States naval ships abroad, with 5000 officers and 70,000 enlisted men, or a greater force than the total strength of the navy when war was declared, while the American fighting craft steamed an average of 626,000 miles per month in the war zone. This did not include the cruisers and battleships on escort duty.

The major naval operation of the war so far as the United States is concerned is given as the convoying of more than 2,000,000 troops to Europe without the loss by enemy action of a single eastbound transport. This accomplishment, the report says, will stand as a monument to both the army and the navy as the greatest and most difficult troop transporting effort which has ever been conducted across seas.—*Washington Evening Star* and *New York Times*, 7/12.

OPERATIONS

DANIELS REPORTS ON NAVY'S WAR WORK.—*Naval Record Unprecedented.*—The record made abroad by the United States Navy, in cooperation with those of Great Britain, France, Italy and Japan, is, he says, without precedent in allied warfare. He pays a high tribute to the efficiency of Admiral Sims, Commander-in-Chief of American naval forces in European waters; of Rear Admiral Rodman, in command of the American battleships with the British fleet; of Vice Admiral Wilson in France, Rear Admiral Niblack in the Mediterranean, of Rear Admiral Dunn in the Azores, of Rear Admiral Strauss in charge of mining operations, and other officers in charge of various special activities.

Our forces in European waters, he says, now comprise 338 vessels, with 75,000 men and officers—a force larger than the entire navy before the war. The navy, in its operations, he says, has "covered the widest scope in its history, naval men have served on nearly 2000 craft that plied the waters, on submarines, and in aviation," while "on land, marines and sailors have helped to hold strategic points. Then regiments of marines have shared with the magnificent army their part of the hard won victory, wonderfully trained gun crews of sailors have manned the monster 14-inch guns, which marked a new departure in land warfare," while naval officers and men in all parts of the world did their full part in the operations "which mark the heroic year of accomplishment."

While the destroyers have led in the anti-submarine warfare, the 406 submarine chasers, of which 335 were dispatched abroad, are given credit for efficient aid, as are also the American submarines sent to foreign waters.

The creation of the Naval Overseas Transportation Service and its growth in less than a year to a fleet of 321 cargo-carrying ships, with 2,800,000 deadweight tonnage, is reviewed, and it is pointed out that this service now requires 5000 officers and 29,000 enlisted men, and is rapidly growing as new ships are completed by the Shipping Board and placed in commission.

Convoying the Troops.—The transportation of 2,000,000 American troops 3000 miles overseas with the loss of only a few hundred lives and without the loss of a single American troopship on the way to France is considered an unparalleled achievement, and Secretary Daniels gives testimony of the record made by the cruiser and transport force, under the direction of Rear Admiral Gleaves. From a small beginning this fleet expanded to 24 cruisers and 42 transports, manned by 3000 officers and 41,000 men,

these being augmented by four French men-of-war and 13 foreign merchant vessels, a grand total of 83 ships. In spite of the constant menace of submarines only three of these troopships were lost—the *Antilles*, *Lincoln*, and *Covington*. All were sunk on the homeward voyage.

Four naval vessels were lost as a result of submarine activity—the destroyer *Jacob Jones*, the converted yacht *Alcedo*, the coast guard cutter *Tampa*, sunk with all on board, and the cruiser *San Diego*, sunk in home waters by striking an enemy mine. The report recalls the loss of the collier *Cyclops*, whose disappearance is one of the unsolved mysteries of the seas.

The estimates for the next fiscal year, which were submitted, in accordance with requirements of law, on Oct. 15, before the armistice was signed, total $2,644,307,046. But the Secretary states that the signing of the armistice will enable radical reductions to be made, and that these will be submitted later.

The report tells of notable achievements in ordnance, especially the work of the 14-inch naval guns on railway mounts on the western front, which hurled shells far behind the German lines, these mounts being designed and completed in four months. The land battery of these naval guns was manned exclusively by blue jackets under command of Rear Admiral C. P. Plunkett. The work of the Bureau of Ordnance is praised, and Admiral Earle, the chief of the bureau, is declared "one of the ablest and fittest officers."

North Sea Mine Barrage.—An account is given of the mine barrage in the North Sea, one of the outstanding anti-submarine offensive projects of the year, thus closing the North Sea, and for which 100,000 mines were manufactured and 85,000 shipped abroad. A special mine loading plant, with a capacity of more than 1000 mines a day, was established by the Navy Department.

A star shell was developed which, when fired in the vicinity of an enemy fleet, would light it up, make ships visible, and render them easy targets without disclosing the position of our own ships at night.

The Bureau of Ordnance, under the direction of Rear Admiral Earle, is stated to have met and conquered the critical shortage of high explosives which threatened to greatly prolong the time of preparation necessary for America to smash the German military forces, TNX, a high explosive, being developed to take the place of TNT, this being sufficient to increase the available supply of explosives in this country to some 30,000,000 pounds.

The work of the bureau in completing a successful Davis non-recoil aircraft gun is declared to be "a great milestone in aircraft armament," and there is given an account of a heavy airplane bomb developed for anti-submarine warfare. Naval gun production is stated to have kept pace with war needs, while the smokeless powder output was increased.

In the future, it is stated, American dreadnoughts and battle cruisers will be armed with 16-inch guns, making these the heaviest armed vessels in the world.

Depth charges are stated to be the most effective anti-submarine weapon. American vessels were adequately armed with this new weapon. A new type was developed and a new gun, known as the "Y" gun, was designed and built especially for firing depth charges.

"The navy that flies" receives special attention, it being stated that the expansion of naval aviation has been of gratifying proportions and effectiveness, many air stations being established at home and abroad. In this branch of the service the total enlisted and commissioned personnel on July 1, 1918, was about 30,000, with 823 trained naval aviators, 2052 student officers, 400 ground officers, 7300 trained mechanics, and 5400 mechanics in training. Naval aircraft had been a big factor in the war, and "aircraft has come to stay," says Secretary Daniels, who plans for its permanency and development.

When war was declared, the navy numbered 65,777 men. On the day Germany signed the armistice this number had increased to 497,030 men and women. When war was declared, there were 197 ships in commission; now there are 2003 vessels in service.

The value of the Naval Reserve is emphasized, and the evolution which brought this into being as an essential part of the navy is recounted. From a small enrollment when the war broke out, this grew to 85,473 by April, 1918, and now numbers about 290,000.

Airmen in Convoy Work.—"In convoy work," *The Army and Navy Journal* continues, "the developments were exceedingly rapid. In this there was complete co-operation between the heavier-than-air and lighter-than-air craft. A great many of the fighting ships were also fitted with kite balloons for observation purposes. The dirigibles were specially useful in that their operation could keep exact pace with the ships in the convoy. The airplanes, because of their speed, had to maneuver in successively progressive loops around the convoy. How successfully this was done is demonstrated by the fact that no transport was lost when under convoy of navy aviators.

"Submarine hunting had a greater development than any other line of seaplane work, and was brought to a point of scientific exactness truly remarkable. In this specialized service the areas to be covered were charted and each patrol was mapped off, the patrols following some mathematical design like a square, triangle, octagon, etc. Such patrol work is generally out of sight of land, and the courses are followed by the use of the compass. It required a tremendous amount of practice, but it was successfully accomplished. Scout work was incident to submarine hunting, and the machines engaged located numerous mines and the positions of many ships.

"Bombing was divided into seaplane and land machine operations. As planned the navy seaplane operations were to be carried on from the southeast coast of England, using lighters as bases when long distance raids were contemplated. The machines were carried many miles toward the Flanders coast by these lighters. Obviously most of the seaplane bombing work was done at night. Land bombing involved both day and night operations and pilots for each class were specially trained. Day flying was at great heights, while night flying was at lower altitudes. It required special study for making lands in the dark.

Fliers on French Coast.—"There are 16 navy aviation stations in France —nine seaplane, three dirigible, three kite, one seaplane training—covering the coast line from Dunkirk on the north well down the west coast toward Spain. In addition there were bombing, training, and supply stations. The stations were headquarters for heavier-than-air and lighter-than-air craft and some combined both classes which, with the exception of the equipment at Dunkirk, were principally used for convoy work and submarine hunting. Dunkirk was almost exclusively used for bombing operations, from which the German bases at Zeebrugge and Ostend received frequent, and, to the enemy, uncomfortable attention.

"Several of the stations in France were equipped only with land machines. These collectively were known as the Northern Bombing Squadron. The principal activities of the squadron were confined to day and night attacks on the various German naval bases and supply depots along the Flanders coast. Several stations were also maintained in Ireland and in England. An extensive station was located at Killingholme, which combined the work entailed in submarine hunting, convoying, and long distance bombing. In addition, there were two stations in Canada and two in Italy on the Adriatic coast. It may now be said that American Navy aviators took part in the bombing of the Austrian naval harbor and arsenal at Pola."

The outstanding single feature of the overseas operations was the northern bombing program which had just got under way in earnest when

Germany collapsed and the fighting ended. Many men were in training for these operations while at Pauillac, France; 4939 picked men were ready to begin the campaign against the Germans when the armistice was signed. Over 500 seaplanes and flying boats were used in patrolling the Atlantic coast of the United States, the patrols covering in September of this year 404,775 miles.—*N. Y. Times*, 9/12.

U. S. S. "OPHIR" DESTROYED BY FIRE IN THE HARBOR OF GIBRALTAR.—The Navy Department is informed that the U. S. S. *Ophir* was destroyed by fire on November 11 in the harbor of Gibraltar. The *Ophir* was en route to Marseille, France, laden with army supplies, when the fire broke out and she was forced to return to Gibraltar. Both ship and cargo were a total loss and two members of the crew lost their lives.

The following men were lost:

Guy Alton Comstock, engineman, second class, United States Naval Reserve Force. Father, Mark Herbert Comstock, 1623 Forty-sixth Avenue, Oakland, Cal.

Oscar Wilson, engineman, first-class, United States Naval Reserve Force. Brother, William Wilson, Bedford Hills, N. Y.—*Official Bulletin*, 20/11.

DESTRUCTION OF U-BOATS BY U. S. WARSHIPS.—United States warships have been credited by the British Admiralty with sinking or capturing nine German submarines, and in a tenth case the Admiralty is not quite certain that the submarine was destroyed, although it seems likely. Destroyers accounted for two submarines, yachts for three, submarines for one and submarine chasers for four. Forty-six vessels were engaged in fights in which it was known that submarines were present. The navy places the total number of fights in which it was reasonable to suppose that a submarine was lurking near at 500. In addition to the German submarines destroyed or captured by American warships, 36 of them sustained damage. Participating in the sinkings were the destroyers *Fanning, Nicholson* and *Tucker;* the armed yachts *Lydonia, Wakiva, Kanawha, Second, Noma* and *Christobel;* the submarine chasers *Nos. 215, 128, 129, 95, 179* and *338,* and the submarine *A1-2.*—*Army and Navy Journal*, 30/11.

AMERICAN SQUADRON NOW CONTROLS POLA.—An American squadron has arrived at Pola, formerly the principal Austrian naval base, and has taken over the command of the port.

Jugoslav war vessels in the harbor have hoisted the American flag, according to a telegram from Laibach, reporting the arrival of the Americans.—*N. Y. Times*, 14/12.

MERCHANT MARINE

INCREASING TONNAGE OUTPUT.—According to the figures just published by the British Admiralty, the world's output of new shipping in the third quarter of the year amounted to 1,384,130 gross tons as contrasted with 870,317 and 1,243,274 gross tons respectively during the first and second quarters. For the nine months ending September 30, the total output foots up 3,497,721 tons. Towards this total, the United States contributed 1,722,730 tons, Great Britain 1,174,641 tons, and allied and neutral countries 600,450 tons. Despite the fact that losses from war and other causes reached the large figure of 892,446 tons, the world's tonnage increased during the last quarter by no less than 491,584 tons. Gratifying as these figures are, they will be far eclipsed during the coming quarter now that the U-boats have ceased their depredations and only losses from floating mines and from ordinary marine disasters have to be reckoned with. New shipping placed in service during the coming quarter bids fair to exceed 2,000,000 tons, three-fifths of which will be turned out in the United States. Indicative of the speed with which our ship-

building output is being accelerated, it appears that 359,521 gross tons of shipping were completed in American yards in November, or 30,000 tons more than during the first three months of 1918. Astonishing as this record is, it is bound to be surpassed in the near future. Only four of the 180 ships to be constructed at the Hog Island yards have thus far been completed. In no month as yet have 400,000 tons deadweight been launched for the Emergency Fleet Corporation, while Director-General Schwab has recently stated that the Shipping Board is aiming to work up to a launching rate of 700,000 tons deadweight a month by next spring. It is apparent, therefore, that our maximum shipbuilding effort will not be attained for some little time to come.—*The Nautical Gazette*, 16/12.

STEAMSHIP LINES RETURNED TO OWNERS.—The Clyde, Mallory, Merchants and Miners', and Southern Steamship Companies were relinquished from federal control to-night by order of Director General McAdoo. Steamship companies owned by railroads will be retained under management of the Railroad Administration.

The four lines turned back to private management were taken over by the government on April 13 under war powers of the President and their operation consolidated with other steamship lines under the Railroad Administration. The relinquishing order becomes effective at midnight to-night, but for accounting purposes it is regarded as effective from Dec. 1.

Leading steamship lines which will remain under Railroad Administration control include the Southern Pacific, or Morgan Lines, Old Dominion, Baltimore Steam Packet, Chesapeake Steamship, Ocean, Fall River, Hartford & New York, and San Francisco, Portland & Seattle Lines.

Harry H. Raymond, President of the Mallory Steamship Company and Vice President and General Manager of the Clyde Steamship Company, declared last night that an effort would be made immediately "to resurrect those lines, so that they might be operated on the basis obtaining before Federal control went into effect."

He said that although no unusual expansion had been planned by these companies, more boats would be needed if trade with South America increased.—*N. Y. Times*, 6/12.

SHIPS BUILT BY U. S. IN NOVEMBER.—One hundred and sixty-five vessels were constructed by the United States Shipping Board during November. Of these 102 are ocean-going, with a gross tonnage of 330,366, and 63, with a tonnage aggregating 18,108 gross, will be used for minor carrying operations.—*Washington Evening Star*, 6/11.

ONE HUNDRED AND FORTY-FIVE AMERICAN VESSELS SUNK DURING THE WAR.—Loss of 145 American passenger and merchant vessels of 354,449 tons and 775 lives through acts of the enemy from the beginning of the world war to the cessation of hostilities Nov. 11, is shown by figures made public to-day by the Department of Commerce's Bureau of Navigation. The report does not include several vessels, the loss of which has not been established as due to acts of the enemy.

Nineteen vessels and 67 lives were lost through use of torpedoes, mines and gun-fire prior to the entrance of the United States into the war.—*N. Y. Times*, 22/11.

ORDNANCE AND GUNNERY

NAVY HAS A STAR SHELL THAT MEETS ALL TESTS.—The fighting efficiency of the American Navy at night will be increased about 25 per cent by the perfection of a star shell operating at long range under all conditions at sea. The new shell, which is said to excel any produced by other nations, and the history of its development are described in a statement to-night by the Navy Department.

The shell is said to be suitable for firing from guns of from three to five inch caliber, and is fitted with a parachute attachment. The shell is filled with illuminating material, guaranteed to burn in spite of the terrific rush of air it meets when freed. The value of the shells lies, said the Navy Department's statement, in illuminating the ships of the enemy without disclosing the position of the craft using the shell.

Experimental work to devělop such a shell was started by the Bureau of Ordnance of the Navy Department in 1909. The war experience of the Allies, both on land and sea, and of the American Navy was utilized in perfecting it.—*N. Y. Times,* 8/12.

NAVIGATION AND RADIO

WIRELESS TELEGRAPHY AND STATIC.—*How the Conquest of This Phenomenon Would Greatly Aid Radio Communication.*—By an Old Radio Operator.—Once more the claim is made that "static"—that bugbear of all wireless men—has been conquered. This time it is in the form of the recent announcement of the Marconi Wireless Telegraph Company of America, which gives full credit for the achievement to the well-known radio engineer, Mr. Roy A. Weagant, who heads the engineering staff of that organization.

By static the wireless man means that form of atmospheric electricity which interferes with the operation of a wireless station. Static is most troublesome during summer months, generally during the hours from noon onward, and particularly from sunset to sunrise. In certain installations the static disturbance appears to be due to the periodic charging and discharging of the aerial system; that is to say, atmospheric electricity is induced and stored in the elevated wires forming the aerial until such time as the potential of the accumulated charge is sufficient to break down the barriers and a current flows through the apparatus and to the earth connection.

Near the waterfront it is often noticeable that static conditions are most severe. The writer has in mind a former U. S. Army wireless station in New York Bay, where it was almost always possible to accumulate quite a static charge in the aerial. When the aerial was disconnected from the ground and from all apparatus, the static charge accumulated until it broke down spark gaps measuring two and even three inches across. When it is remembered that it takes roughly 20,000 volts to spark across a one-inch gap between needle points, the potential of the accumulated charge is soon obvious.

But the usual form of static is far milder than that just mentioned. Instead of accumulating in the aerial system, it flows steadily through the aerial and the apparatus to the ground, making its passage known by affecting the receiving apparatus and thus interfering with the reception of signals. Such static is due to electrical discharges between clouds and between clouds and the earth. Even with a blue sky overhead, such disturbances often prove most troublesome, in which case they are most likely due to a distant thunderstorm. Lightning discharges can be detected at considerable distances by any wireless receiving set, and such static disturbances generally prevent the handling of wireless traffic long before the storm clouds come over the horizon.

Static disturbances in the early days of radio communication, when the coherer and Morse register were employed for recording the signals in the form of dots and dashes on a paper ribbon, took the form of a jumbled lot of dots and dashes. Often these nondescript dots and dashes persisted for hours and even days; for it was next to impossible to eliminate the static and still receive the signals because of the comparatively insensitive detectors and weak transmitters of those days. Furthermore, there was no way of differentiating between the static rumble and the signals, as is possible to some extent with the audible receiving systems of to-day.

With the introduction of the telephone receivers and the audible method of reception, static took the form of strange sounds. Generally, static

sounds like hailstones beating against a sheet of tin. Again, it may sound like short hisses from a steam pipe, or periodic discharges of coal down a chute. The tone of static is generally very low, while that of wireless signals is generally higher, particularly at present.

Of the various means of mitigating static, perhaps the earliest was better means of tuning. By tuning is meant the bringing of the transmitter and receiver into sympathy or tune, so that the receiver responds to the signals of the selected transmitter to the more or less total elimination of other signals. Tuning has greatly aided in the combatting of static. From the simple circuits of the early wireless receivers, there have come those systems in which several circuits are arranged in series, all inductively coupled. That is to say, the current in the serial circuit induces a secondary current in a second circuit; and this current, reacting on a third circuit, induces a third current which is brought to bear on the detecting device which in turn operates the telephone receivers worn by the operator. Such an arrangement permits of elaborate tuning, and the inductive coupling may be made either tight or loose; so that by a process of elimination one train of signals after another can be cast out until the desired one alone remains.

But the great thing to bear in mind with regard to elaborate tuning circuits is that there is a loss in transferring currents inductively from one circuit to the next. This, however, has been overcome by the powerful transmitters of to-day, which assure the transmission of a sufficiently powerful train of waves to withstand the "weeding out" process at the receiving end.

Elaborate tuning circuits have done much to master static, although static, being of a very wide wave length and therefore not susceptible to delicate tuning as are the transmitted waves, has often come through all tuning circuits along with the desired signals. Most of the systems in which the conquest of static has been claimed, have been based on intricate tuning systems which have sometimes worked and sometimes not.

Another method of handling static has been by means of the recent "beat" type of receiving sets. In these sets a local wave generator, usually of the vacuum valve design, can be adjusted to produce an undamped current of any desired frequency. This current is introduced in the same circuit as the received signals, so that by having a slight difference in frequency between the incoming signals and the locally generated waves, the two currents alternately help each other and oppose each other, producing "beats" or periodic signals. Such systems have proved comparatively effective in handling static, since they permit of a fine distinction between all signals received with a view to selecting just one of them. However, the "beat" receiver responds best to those signals known as undamped waves, as compared with the damped waves generally employed.

Still another method has been to employ a tuned reed in place of the usual telephone receiver at the receiving station. Thus the tuned reed responds only to a signal of the correct pitch, to the exclusion of all others. Static is generally pretty well eliminated by such harmonic forms of receivers—and so are all other signals for that mater, proving disadvantageous at times.

The skilled operator can generally read signals through static disturbances unless the static is too loud. With modern transmitters which emit high-pitched signals of whistle-like sound, the signals can be readily distinguished above the static din the greater part of the time. It is only in long-distance communication that static forms the greatest obstacle, and that accounts for the frequent and long shut-downs in some of the trans-oceanic wireless stations.

So it is evident from what has been said in the foregoing that there have been numerous ways of removing static under *certain* conditions. But what has been wanting all these years is a way that will eliminate static under *all* conditions. Perhaps Mr. Weagant has discovered some new and totally different way of handling received signals. If so, then there is much promise for the future of radio communication.—*Scientific American*, 7/12.

WILSON APPROVES MAKING WIRELESS A NAVY MONOPOLY.—Permanent government control of all radio communication through the acquisition and operation by the Navy Department of all shore wireless stations in the United States used for commercial purposes is planned by the administration under a bill now before Congress.—*Washington Evening Star.*

DRIFTING MINES.—It is stated that 25 mines were sighted by a steamer recently off the Atlantic coast. There will probably be many floating mines for months to come and doubtless some marine accidents will result. Of course, measures will be taken to pick up and destroy these menaces to navigation, but it is almost impossible that all should be found, and ship captains must run a certain degree of risk. After the Russo-Japanese war ships were sunk for a long time after the cessation of hostilities, as mines were carried out into the Pacific, some of them torn from their moorings and others being drifting mines. It is not known how many free mines the Germans set afloat, but it is believed a great number were thus started forth on missions of destruction. Fortunately the trend of the currents in the North Sea is into the gulf stream, flowing toward Spitzbergen. There is a return current west of Iceland which might bring mines back by the Labrador current into the navigation zone between the gulf stream and the coasts of Newfoundland, Nova Scotia and northeastern United States, which is the principal steamer lane. Mines that chance to work their way through the English Channel might get down into the Canaries current, and so flow into the gulf stream from the south. Were the current conditions otherwise than they are the danger from this source would be extremely grave. Mine sweeping must be continued with unremitting diligence until the seas are made safe again.—*Washington Evening Star,* 10/11.

VARIATIONS IN THE DIP OF THE HORIZON.—W. J. Peters, of the Carnegie Department of Terrestrial Magnetism, has recently published the results of extensive observations made during the cruises of the *Galilee* and the *Carnegie* on the variations in the dip of the horizon due to refraction. This subject has previously been investigated from time to time, especially by the Germans. An official German text-book of navigation states that the horizon has been observed as much as 15 minutes above and three minutes below its normal position. Bowditch's American Practical Navigator gives an even wider range. The subject is of practical importance, since each minute of abnormal refraction means an error of a mile in the determination of the ship's position. The observations described by Peters appear to have been taken with special care, and number no less than 3031 determinations. In all of these measurements the horizon was never raised by refraction more than 2.4 minutes nor depressed more than 2.0 minutes below the position in which it would have been seen (*i. e.,* the normal dip, due to the elevation of the observer above the sea) if no refraction had existed. Most of the measurements were taken with a Pulfrich dip-of-the-horizon measurers made by Zeiss, of Jena. Mr. Peters thinks that the extraordinary values that have been occasionally reported may be peculiar to certain regions, where the navigator should be ready to detect them either by observing stars in different azimuths or by special instruments or attachments to the sextant. He adds that when aerial navigation across the oceans is realized, if astronomical methods of navigation are used, some simple means of measuring the dip of the horizon will become highly desirable.—*Scientific American,* 16/11.

ENGINEERING

THE SEMI-DIESEL OIL ENGINE.[1]—By James Richardson, B. Sc., A. M. I. C. E.—*Introduction.*—On several recent occasions, authorities, when forecasting the lines of development of the oil engine, have expressed the

[1] Paper read before the Diesel Engine Users' Association, on Thursday, October 24, 1918.

opinion that the so-called semi-Diesel engine would play no inconsiderable part. It might be matter for surprise that publications of technical matter dealing with the semi-Diesel engines are extremely rare in comparison with the vast amount of available data relating to the Diesel engine.

Definition of the Semi-Diesel Engine.—The variously-named semi-Diesel, hot-bulb or surface-ignition engine may be defined as an internal-combustion engine, using oil fuel, which has an uncooled portion of the combustion chamber, normally at high temperature, serving to augment the heat generated by the compression pressure and to assist in the vaporization and ignition of the fuel injected at the ignition point of the cycle. From this class should rightly be excluded those oil engines which are not called by their makers Diesel engines, but which rely for ignition, as completely as the Diesel engine, upon the heat generated by the compression of the air charge, and therefore should be so named. The means of injection of the fuel with such engines may vary from the standard air injection system.

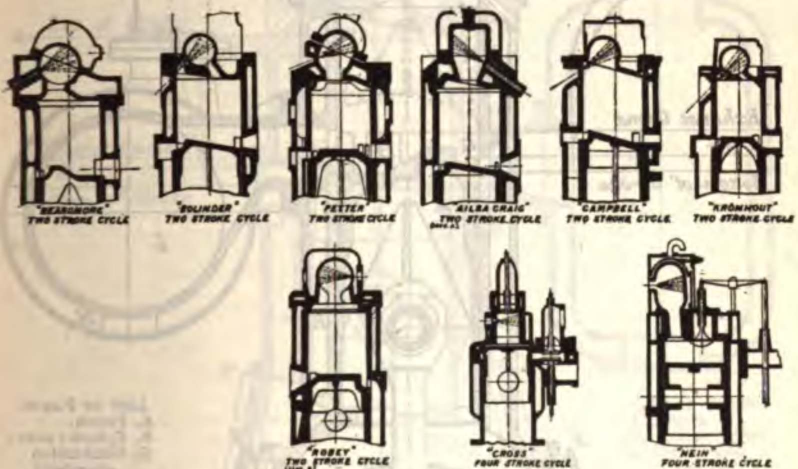


FIG. 1.—Nine Representative Types of Semi-Diesel Engines.

Nomenclature.—In describing and classifying engines of the semi-Diesel type, it will be necessary generally to adopt the nomenclature and technical expressions familiarized by the literature dealing with the Diesel engine, and convenient often to describe by means of comparison with the better-known Diesel engine.

Classification.—The many types of engines of the type under review vary considerably (see Fig. 1) and can be classified according to the cycle of operation upon which they work, whether the two-stroke or the four-stroke cycle, and according to the extent to which the heat of compression is relied upon for the vaporization and ignition of the injected fuel. In the present stage of development, the chief claim of the semi-Diesel engine to be considered in the forefront of internal-combustion prime movers, is its marked simplicity. Development along probable lines may reasonably and in the near future reveal qualities to gain which a certain degree of simplicity may well be sacrificed. Primarily for reasons of simplicity, the great majority—more than 90 per cent—of these engines at the present time are designed on the two-stroke cycle principle, limited to its simplest application, and are generally confined to relatively low powers per working cylinder, 125 brake

horsepower per cylinder being the maximum attained up to the present time. Fig. 2 shows cross-sections of a Beardmore two-cycle semi-Diesel compression engine and Fig. 3 of a low-compression engine, with references. Fig. 10 shows an external view of a four-cylinder engine of the same make. On the same page are external views of single-cylinder engines by Messrs. Robey and Co., Limited, of London, and by Messrs. Petters,

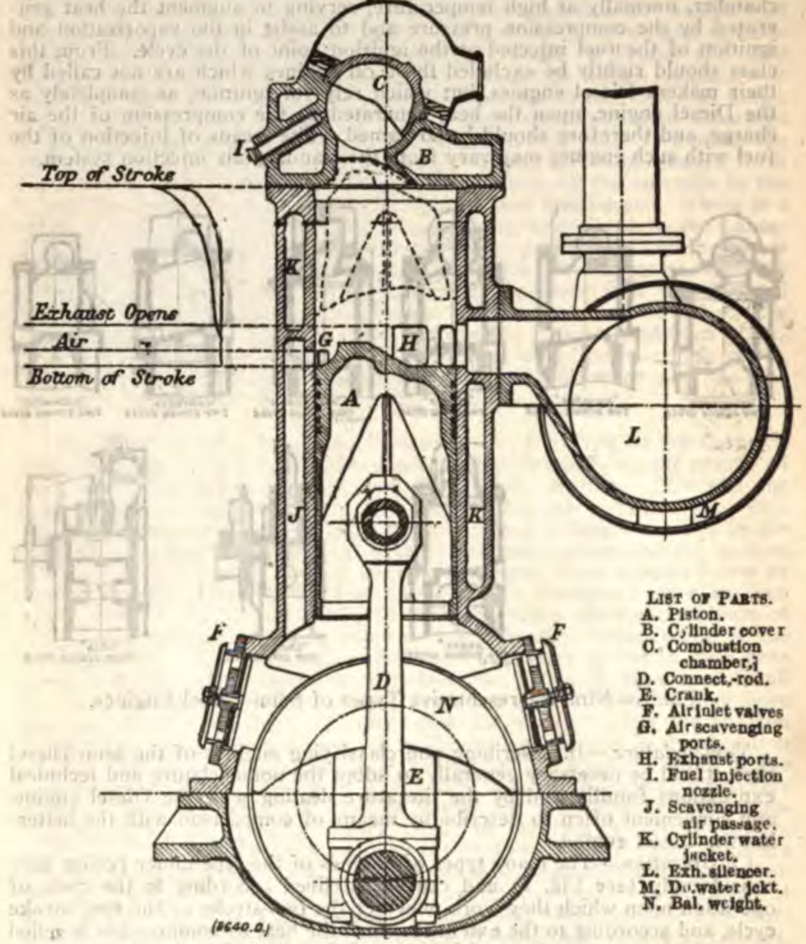


FIG. 2.—A. The "Beardmore" Two-Cycle Semi-Diesel Engine. High Compression Engine.

Limited, of Yeovil. The former are made in sizes from 6 to 50 horsepower with single cylinders, and from 24 to 100 horsepower with two cylinders. Fig. 12 shows Messrs. Petters' latest type, which is made in 35 and 50 brake horsepower sizes.

Some of the earlier semi-Diesel engines used air injection of the fuel, but this type was not developed, due primarily to the disadvantage of the extra

complication of compressors and their attendant gear. All modern engines of this work with "solid" or "mechanical" injection of the fuel, because of the simplicity of this system, considered especially in conjunction with the hot bulb for assisting the vaporization and ignition of the injected fuel. Air compressors are again making their appearance on semi-Diesel engines, although not for the purpose of air injection in the ordinary accepted meaning of the term. An air jet is used to cool the combustion chamber and

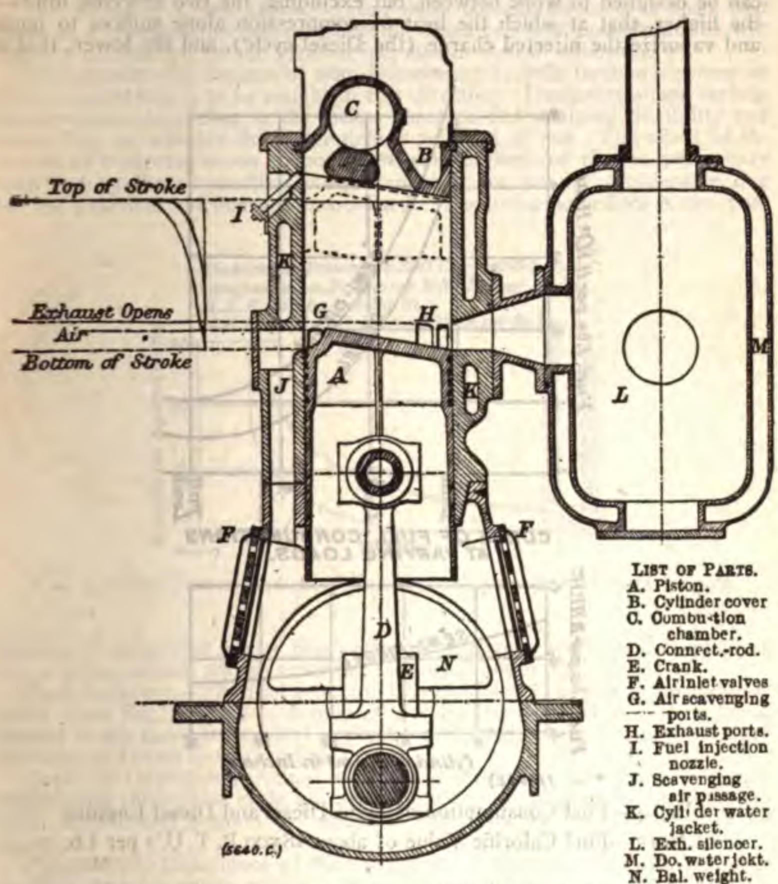


FIG. 3.—B. Low Compression Semi-Diesel Engine.

piston, and so to take the place of the water-drip (mentioned later), to increase the efficiency of the scavenging of the main cylinder, and so to make possible engines of relatively high powers, *i. e.,* over 100 brake horsepower per cylinder, without having recourse to such expedients as separate scavenging pumps, elaborate cooling systems for the main pistons, and so forth.

Compression Pressure.—With all internal-combustion engines, theory teaches that the higher the compression pressure the less the fuel consumption, the less the heat required from an outside source to attain to the

temperature necessary for the first working cycle when starting from cold, the higher the average mean effective pressure reached in the working cylinder, and consequently the smaller the main piston-swept volume for a given indicated horsepower. On the other hand, the lower the compression the more even the turning moment, generally the higher the mechanical efficiency, and the less the effort required to start the engine from rest by way of overcoming the negative work of the first compression stroke.

The semi-Diesel engine in type is a variable compression oil engine, and can be designed to work between, but excluding, the two extreme limits—the higher, that at which the heat of compression alone suffices to ignite and vaporize the injected charge (the Diesel cycle), and the lower, that at

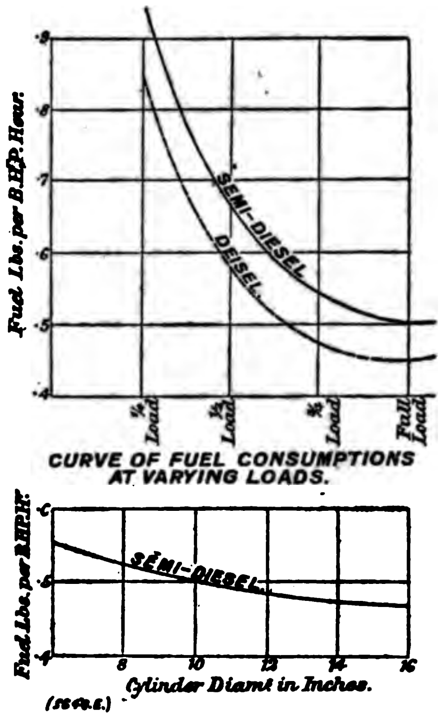


FIG. 4.—Fuel Consumption of Semi-Diesel and Diesel Engines.

NOTE.—Fuel Calorific Value of about 18,500 B. T. U.'s per Lb.

which the size of the hot bulb becomes inconveniently large for reasons of strength, when the loss from the hot bulb, by radiation, would be a serious factor, and together with the small power output obtainable with low compression, would tend towards an excessively high fuel consumption and a large engine.

The Disadvantage of High Compression.—There are disadvantages attendant upon high compressions, and a compromise between the theory that the higher the compression the greater the economy and practical considerations, must be struck. In comparison with steam prime movers, the mechanical efficiency of internal-combustion engines is low, due primarily to the friction of the piston rings. (See Appendix I.) The higher the

compression and consequently the maximum pressures the greater this loss on account of the larger number of rings required to ensure satisfactory gas tightness, and the greater the pressure exerted by these rings when forced against the piston walls by the cylinder pressure operating behind the rings.

A further outcome of high pressures is increased piston-ring leakage, and the effects of piston-ring leakage upon economy are very considerable. The higher the compression pressure the greater the heat transfer from the charge in the cylinder to the jacket cooling water.

The Effect of Compression.—From these considerations it is clear that there is a compression pressure beyond which practical considerations will cause a diminution rather than an increase in overall efficiency.

With present-day designs of semi-Diesel engines little further economy of fuel consumption is to be sought in this direction. Designers adopt various compressions according to the means foreseen for attaining flexibility and depending on whether the water drip is retained or not. The effect of increase of compression on economy between the limit of 180 lbs. per square inch and 450 lbs. or 500 lbs. per square inch is not, *per se*, considerable, due to the practical considerations outlined. The principal effect is the pos-

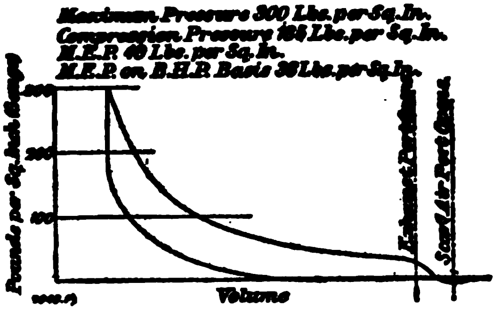


FIG. 5.—Full-Power Indicator Card of 2-Cycle Semi-Diesel Engine.

sibility of sustaining higher mean effective pressures with smaller cylinders for a given output, and so attaining somewhat better fuel economy.

Fuel Economy.—The fuel economy of semi-Diesel engines is surprisingly good (see Fig. 4), and is accounted for by the cycle of operation being nearer to the more economical explosion cycle than to the constant-pressure burning or Diesel cycle (see Fig. 5).

Cycle of Operation.—Actual indicator diagrams do not quite so rigidly follow the theoretical cycle as the gas engine, on account of the difficulty with semi-Diesel engines of regulating the injection and ignition for all loads.

Flexibility.—Experience of the operation of internal-combustion engines teaches that this prime mover is primarily a constant speed, and to a somewhat lesser extent a constant load engine. Innumerable designs of details and countless patents have been concerned with the problem of flexibility and compromise is generally the outcome. Flexibility can be considered under three headings:

(a) Constant mean effective pressure, with varying revolutions and consequently power.

(b) Constant speed of revolution and varying mean effective pressures and power.

(c) Varying speeds and mean effective pressures.

Condition (a) is not required in practice, and cannot normally be met, with maximum or even full load m. e. p. since with a reduction in speed of revolution, conditions affecting scavenging efficiency and compression, heat loss, etc., also change, and a small drop in speed of revolution is accompanied by a reduction in m. e. p., and so by a cumulative falling-off in power developed. A low m. e. p. can, of course, be maintained as a constant over a certain range of speed of revolution.

Condition (b) constant speed of revolution and varying power as affecting generator engines, etc., requires most frequently to be met, and may be considered in detail. At reduced power and m. e. p.'s—

(1) The charge drawn into the crank chamber remains relatively constant in volume or may even be slightly augmented, due to the engine running cooler as the mean effective pressure falls, unless means are provided to throttle the water cooling supply.

(2) The volume of the scavenging charge is approximately the same as at full power, but may be at a lower temperature and pressure.

(3) The compression pressure will be reduced on account of: (a) Lower scavenging pressure (see 2); (b) less heat abstracted from the cylinder walls, which in turn is due to the less fuel burnt per stroke and so the lower temperature of these walls. Condition (c) requires to be met with various types of machinery, and no difficulty is experienced provided the power of the engine is suitable for its work and a higher m. e. p. is not demanded than can be sustained for the speed of revolution under consideration.

Even where means are provided to throttle the cooling water and the scavenging air at low power, the point is quickly reached where the heat of the bulb is insufficient to vaporize and ignite the charge of injected oil, and the engine will "miss" and stop unless heat be externally applied to the bulb as, for instance, by the blow lamp.

Range of Working.—The range of working must be extended to cover from full load or overload to a small load without having recourse to the blow lamp, and for this purpose the water drip has been retained on some designs. At full load water is allowed to enter the working cylinder with the scavenging air and serves by evaporation to take heat from the bulb, so that with a relatively large bulb and a low compression engine, from three-quarters to full power can be satisfactorily developed without overheating of the bulb, and with the water drip cut off the engine will run satisfactorily down to low loads. An overheated bulb will give bad combustion and "coking" of the fuel, and is, besides, a source of danger due to weakening of the metal of the bulb (see annexed table).

TABLE SHOWING TENSILE STRENGTH OF COMBUSTION CHAMBER MATERIALS AT VARIOUS TEMPERATURES

Load on engine	Color	Temperature deg. F.	Tensile strength of cast iron tons per sq. in.	Tensile strength of mild steel tons per sq. in.
Light load....	Just showing color in the dark	750	12	24
Normal load...	Between dull and cherry red	1,100	7.5	12
Over-load	Bright cherry red.........	1,400	3.5	2.5

Consumption of Water.—The consumption of water through the water drip is very considerable, and varies according to the quality of attention given to the running of the engine, but may reach a value at high powers much in excess of the quantity of fuel burnt. The water should be as pure as possible to cause the minimum harm from deposits on the working surfaces. Water has a deleterious influence on the lubrication of the internal parts, although it is credited with preventing carbonizing of the main

piston rings. The water drip, however, is a crude solution of the problem of flexibility, requiring a large supply of fresh water, and with varying loads, regular attendance to the engine, since it is somewhat difficult and calls for complicated gear to connect the water supply with the governor in the same way as is necessary with the fuel supply.

The better solution is to take advantage of another law which is not yet completely explained, viz., that the temperature generated within the cylinder of an internal-combustion engine depends on the load, the compression temperature, and upon the nature of the ignition, whether early, normal or late. Normal ignition may be said to be that ignition which is correct for maximum economy and will give the highest power without trouble, the cleanest exhaust, the sweetest running, etc. Late ignition makes for excessive heat losses to the exhaust and high fuel consumption. Early ignition gives rise to abnormally high temperatures. This last fact is utilized with semi-Diesel engines to counteract the cooling of the bulb with reduced

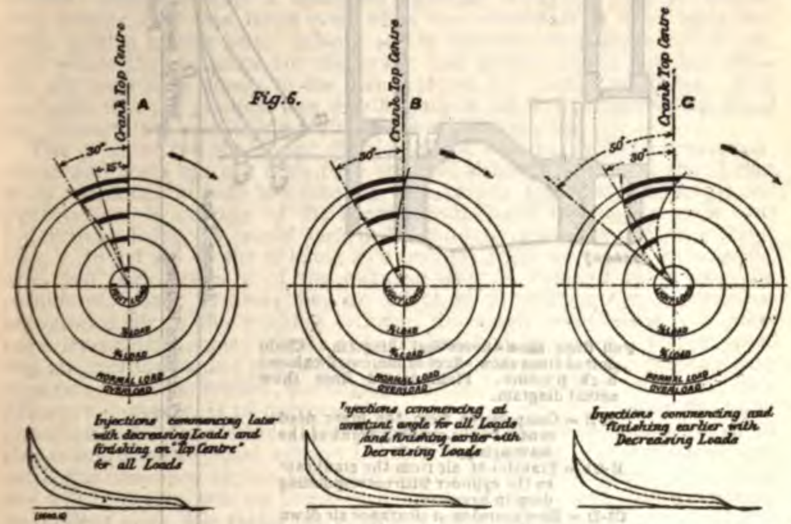


FIG. 6.—Diagram Illustrating the Control of the Point of Commencement and Period of Injection for Varying Quantities of Fuel and Load Giving Corresponding Indicator Diagrams.

power. By advancing the point of ignition of the fuel charge, as the quantity of fuel is reduced to correspond with the load, the semi-Diesel engine can be made to give satisfactorily running at all loads from full load to no load with the minimum of attention and without requiring external heating of the bulb (see Fig. 6). The governor controls the quantity of fuel to correspond with the load by varying the stroke of the fuel pump, and gears have been designed whereby with reduced quantity of fuel the injection point is advanced according either to B or C in Fig. 6. Scheme C is most necessary for engines requiring to run for long periods at light loads, whilst B suffices generally; C is less easy of attainment by a simple gear.

Scavenging.—The next point of importance is the question of scavenging, which, so far as published data or the results of experimental work are concerned, is almost an unexploited field, in connection with either the two-cycle Diesel or semi-Diesel engine. With two-cycle engines the efficiency of

scavenging is lower than with four-cycle engines, which has proved one of the most important deterrents in all spheres of application to that success so often predicted in the past for the two-cycle principle. With two-cycle semi-Diesel engines the amount of air available per working cycle or per revolution for scavenging is limited to the volume swept by the working piston. More air than this cannot be drawn into the crank chamber (unless an induction system to the crank chamber were so designed and fitted, as to give a momentum effect with a slight gain, which subject has not yet been studied for other than high-speed four-cycle engines where the maximum output per unit volume is essential). The air, after being drawn into the crank chamber, is impregnated with a certain amount of lubricating oil, as

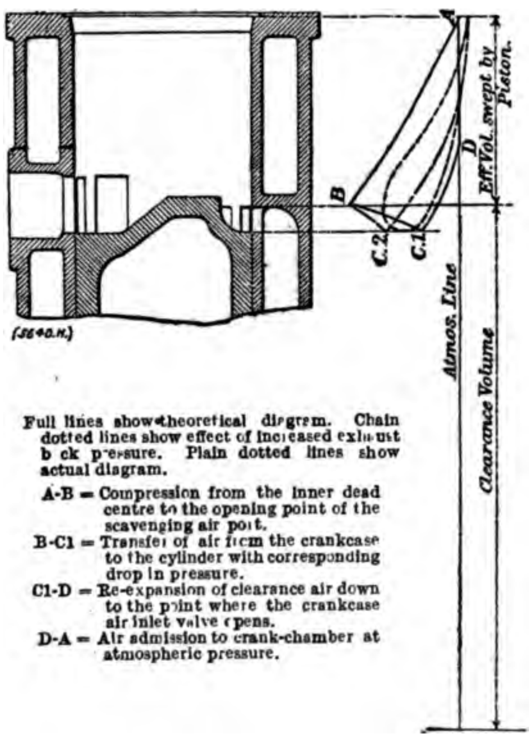


FIG. 7.—Crank Case Indicator Diagram.

Suction loss due to attenuation of the charge is shown by the air admission line of the actual diagram falling below the atmospheric pressure line. The actual compression line is below the theoretical *A B*, because compression commences at a lower pressure and on account of leakages. Volumetric efficiency of the scavenging pump is greatly affected by the exhaust back pressure, as the position of the polnt *C1* controls the position of the point *D*, as shown. The chain dotted line shows the effect of increasing the exhaust back pressure from *C1* to *C2*. The further *D* is from *A* the greater is the volume of air represented and dealt with in the crank chamber. Exhaust back pressure affects the quantity of air transferred to the working cylinder, but has no influence on the scavenging air pressure.

will be discussed later under the heading of "Lubrication," and withdraws a certain heat from the working parts of the engine, especially from the piston. An indicator card and the theory of the scavenging is given herewith (see Fig. 7).

Efficiency of Scavenging.—Scavenging efficiency can be subdivided under two headings, the efficiency of the pump and the efficiency of the scavenging of the working cylinder. As seen from the comparison of the ideal with the working indicator diagram, Fig. 7, there are several losses in the pump:

(1) Suction loss due to attenuation of the charge.

(2) Compression loss due to leakage through the main bearings.

(3) Loss of volumetric efficiency due to the heating and re-expansion of the clearance air.

To take the three points in order; suction loss requires no explanation. Loss due to leakages through the bearings is now reduced to a minimum with careful design of the air rings and good workmanship. Fig. 8 shows an arrangement which has proved satisfactory. The clearance volume should be kept a minimum although with this type of engine, this volume is always large even when the crankshaft is fitted with balance weights to give better balance and to minimize this clearance volume, and where the clearance for the crank and bottom end is cut fine, since the air must have access to the piston crown for cooling purposes. It is probable that the greatest loss of efficiency is not in the scavenging pump but concerns the scavenging within the working cylinder.

The effect of the shape, and the size of the scavenging and exhaust passages and ports has not been fully studied, although it can be stated that wide variations in both are possible without any appreciable effect on the performance in practice of the normal semi-Diesel engine, the main considerations being, as would clearly be inferred from the indicator card, Fig. 7, to get rid of the exhaust at a suitable point as rapidly as possible, and that back pressure of the exhaust must be reduced to an absolute minimum. Back pressure has an effect in preventing the entrance of scavenging air to the working cylinder, previously compressed to a pressure dependent in some measure upon the speed of revolution. The scavenging air pressure cannot increase to overcome exhaust back pressure as with separate valve-controlled scavenging pumps. The chief effect of back pressure, however, is to decrease the quantity of air drawn into the crank chamber to be compressed. The pressure from which the clearance air in the crank chamber must expand is the back pressure of the exhaust, and until this clearance air has expanded down to the suction pressure no fresh air will be drawn into the crank-case. The volumetric efficiency is entirely dependent upon this factor, as is clearly shown in Fig. 7. Large exhaust ports, ample passages, the close proximity of a large silencer to the cylinder and the minimum of restriction in the exhaust pipes are necessities.

The two-cycle semi-Diesel engine has almost settled down to a standard design of scavenging and exhaust passages and piston crown without any proof other than that of satisfactory performance, although still at relatively low efficiency. Much experimental work still remains to be done on this subject. This course involves considerable labor and expense due to the large numbers of variables that have a direct influence, of which but a few will be mentioned. Piston speed must have an effect on the efficiency of both the crank chamber scavenging pump and of the cylinder scavenging. Experience has shown that 300 feet per minute approximately is the maximum piston speed, above which with present designs the scavenging efficiency falls off somewhat rapidly, the power output from the engine fails to increase with higher revolutions and increased fuel, and the limiting condition of maximum powers are reached.

With this question is intimately associated the subject of the stroke-bore ratio; it can be said that the higher the stroke-bore ratio, the better the conditions of cooling of the piston, because the smaller the diameter of the

piston for a given power, and so the shorter the path for the heat to travel from the center to the cooled walls; also the lower number of revolutions for the desired output of power gives certain advantages for driving types of machinery which are inherently slow speed machines. Furthermore, the author's experience suggests the larger the stroke-bore ratio within the limits of ratio of 1 to 1 and 1.5 to 1, the less, probably, the escape of scavenging air through the exhaust ports, due to a greater quantity of fresh air being entrapped in the combustion chamber, *i. e.*, with a square engine—an engine of approximately equal stroke and bore—a greater percentage of the scavenging air finds its way out through the exhaust ports.

The shape and angle of entrance to the cylinder of the air inlet passages, the type of baffle on the piston crown and the location of the bulb in relation to the path of the scavenging air all have an influence.

Injection.—To turn to the question of injection, which depends primarily with a solid injection semi-Diesel engine, on the following factors:

(1) Turbulence within the cylinder.
(2) Pressure of fuel and rate of injection.
(3) Point of the cycle at which injection occurs.

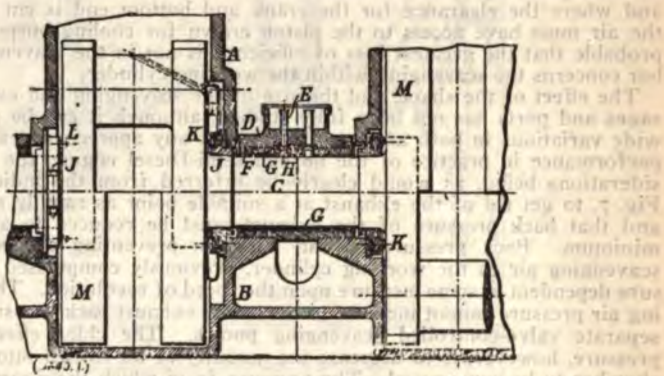


FIG. 8.—Arrangement of Rings for Securing Air Tightness of Crank Chamber Showing also System of Lubrication of Main and Crank Pin Bearings.

List of Parts.

A. Cylinder and top chamber.
B. Soleplate.
C. Crankshaft.
D. Main gearing cover.
E. Main gearing cover, oil tubes.
F. Main gearing bushes.
G. Main gearing bushes, white metal.
H. Main gearing bushes, oil tubes.
I. Centrifugal oiler.
J. Airtight rings.
K. Airtight rings, springs.
L. Airtight rings, driving pins.
M. Balance weights.

(4) Fineness of the spray.
(5) Distance of injector from the hot igniting surface.

These points are not given necessarily in order of importance. Turbulence, apart from piston speed which is governed as already stated by consideration of scavenging, is determined by the shape of the piston crown and the combustion chamber, and in the immediate vicinity of the spray by the shape, speed and volume of the spray. The question of turbulence is an exact parallel to that of scavenging and as yet has received little attention, excepting for the experiments arising out of the necessity to burn tar oils in Diesel engines.

The pressure of injection is governed by the piston speed of the fuel pump or by the angle of crank revolution allowed for the injection of the fuel and by the size of the orifice or orifices in the injector. Pressure is necessary more to give momentum to the stationary column of oil than to secure fineness of the injection spray. It is an absolute essential that injection shall be as rapid as possible, and the injection devices so designed that no "after drip" takes place.

The angle of revolution allowed for the injection period is governed by the ratio of diameter to stroke of the fuel injection pump which injects the fuel through a non-return valve or valves direct into the hot bulb. Obviously with a large diameter and a small stroke fuel pump the period is short and conversely. Practical considerations of design of the pump and governing mechanism determine the period for full power running to be about 30 degrees (see Fig. 6). As regards fineness of spray, no standard has been fixed, although the spray can certainly be "too fine" for rapid ignition.

The next essential is probably that the whole of the oil should be in the combustion chamber in the form of a spray before the first particle touches the hot bulb, which again is a function of rapidity of injection and of the distance through which the oil is thrown, arguing in favor of a long-distance of throw to give rapid ignition and the maximum degree of turbulence in the vicinity of the spray, although a long throw will militate against flexibility. The efficiency of the scavenging will determine to what extent the hot bulb is charged with burnt gases or with fresh air, and will thus have a direct influence upon the speed of ignition and combustion.

Fuel.—In view of the simplicity of this type of engine in comparison with the usual four-cycle internal-combustion gas or Diesel engine, it might be matter for surprise that the semi-Diesel engine has not made greater headway in the past than has been the case. The one outstanding difference between the semi-Diesel and the Diesel engine has been the small range of working fuels with which it could satisfactorily cope. It is but a few years since the great majority of these engines almost required paraffin or the very lightest of petroleums for their successful operation in practice with reasonable costs for upkeep and maintenance. Recently, however, the advantages of simplicity of this engine have been more generally recognized and have led its producers to experiment on the question of utilizing fuel oils of a heavier nature, which have been more readily procurable within the last few years, thus extending greatly the field of application. This movement has been largely responsible for many attendant improvements such as increasing the compression pressure.

The present stage of development of the semi-Diesel engine permits it to use most of the heavy fuel oils ranging from 0.8 to 0.9 in specific gravity and with flash points from 130° to 250° F. Perhaps the most frequently used oils are "Solar" and "Shale," but paraffin at the one end of the scale and Texas at the other may be said to be quite suitable without special adjustments or contrivances. Very thick oils such as "Mexican" for example, may be used, but require preheating to facilitate pumping, and periodical runs on lighter oils are desirable in such case in order to keep the pipes clear, the pistons clean, and the piston rings free in their grooves. With regard to sulphur, the semi-Diesel is no more sensitive than the Diesel engine. Experiments are being carried out at the present time in order to permit of the use of tar oil.

A note should be made in connection with the subject of burning heavy fuel oils with semi-Diesel engines, that this engine being a "solid" injection engine does not run with such a clean exhaust as is customary with air-injection engines, and the amount of overhauling required for cleaning of piston rings, etc., is on that account greater, and, of course, is increased with the heavier oils as compared with shale oil and such lighter oils. The user must, therefore, balance the gain of cheap and readily-obtained fuels with the extra overhauling which may on that account be required, taking

into account the size of the engine as to whether the parts to be handled are of convenient size and weight.

Lubrication.—On the subject of lubrication, Fig. 8 shows the means provided for the main and the crank-pin bearings, and Fig. 9 illustrates a satisfactory device for the lubrication of the connecting-rod top end bearing, whereby the oil is collected from the cylinder walls and conveyed to this bearing. The lubrication of the cylinder walls is carried out in exactly the same manner as is customary with Diesel engines, a special lead being provided for the top-end bearing. Forced lubrication to the main, crank-pin and top end bearings cannot be used with semi-Diesel engines, so long as crank-case scavenging is utilized in order to avoid excessive impregnation of the crank chamber air with lubricating oil.

The qualities of lubricating oil desirable for semi-Diesel engines differ in no way from those required by the Diesel engine, and, with careful design of the airtight rings shown in Fig. 8, and good fitting piston rings, the

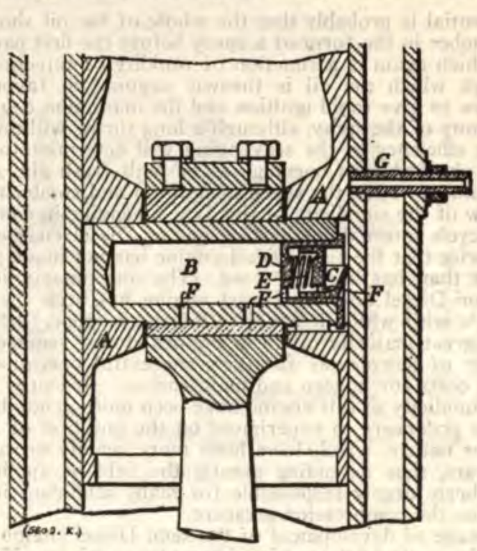


FIG. 9.—Lubricating Oil Collector for Gudgeon Pin.

List of Parts.

A. Piston.
B. Gudgeon pin.
C. Oil collector.
D. Oil collector casing.
E. Oil collector spring.
F. Oil holes.
G. Oil tube from lubricator.

consumption of lubricating oil compares favorably with the figure for two-cycle Diesel engines, and is in the neighborhood of 0.02 lb. per brake horsepower per hour.

Starting.—Semi-Diesel engines are started by means of compressed air. Due to the low compression pressure, a comparatively low pressure of starting air is sufficient to ensure reliable starting. The minimum pressure at which the engine will start is from 80 lbs. to 100 lbs. per square inch, and the starting air is generally stored at 200 lbs. per square inch, which, with a suitable volume of storage, gives the requisite number of starts, or a margin for contingencies. Prior to starting the hot bulb is brought to a sufficient

temperature to ignite the fuel, which is accomplished by means of a blow lamp in from 10 minutes to 15 minutes. If the engine is provided with special starting plugs of nickel steel screwed in the hot bulb, very much less time is required. These special plugs quickly attain the necessary temperature for ignition. One impulse is generally sufficient to start the engine, so that operating gear for the starting air valves, other than a hand lever, is not customarily fitted with land engines, excepting occasionally in the case of four-cylinder engines. For the compression of starting air a separate hand or power-driven compressor can be installed. The practice with semi-Diesel engines is, during each working stroke to tap off a portion of the working gases through a combined non-return and screw-down valve on the main cylinder, and to pass them to the starting reservoir or reservoirs until such time as any reduction of contents of these reservoirs has been made good.

For multi-cylinder engines which require to start against a load, as for instance those driving pumps or propellers, the same mechanism can well be fitted as with the Diesel engine, the starting air valves being operated either from a main camshaft or through a distributing box, with a secondary camshaft driven from the crankshaft. The quantity of air storage requisite for starting is generally considerably less than is required by Diesel engines, since the hot bulbs have, of necessity, been heated prior to turning the engine, and one revolution on compressed air is sufficient to start the engine.

The quality of reversibility, which is almost exclusively required for marine engines, presents few difficulties where two-cycle semi-Diesel engines are concerned, and some notes in regard to this subject are given in Appendix II.

Reliability and Regularity in Operation.—As would be expected from the extreme simplicity of this prime mover, its reliability and regularity in operation are of a high order. Due to the necessity of restricting the quantity and minimizing the pressure of lubricating oil, as already dealt with under the heading of "Lubrication," earlier designs were subject to bearing troubles attributable to the failure of the lubricating system. With modern designs ample bearing surfaces and carefully-designed means for the provision of the necessarily restricted quantity of lubricating oil, these defects have been entirely eliminated.

The system for fuel injection due to the adoption of "solid" or "mechanical" injection is considerably simplified in comparison with air injection engines.

Faulty circulation of cooling water and unsatisfactory designs of castings—more particularly those for the cylinder head and hot bulb—have been the cause of a certain amount of trouble with cracked heads and so forth; but modern designs have practically overcome this earlier source of unreliability.

Conclusion.—The rapid extension within the last few years not only of the field of application, but also of the size of engine and power developed per cylinder with semi-Diesel engines, foreshadows considerable developments in the near future. In these developments the influence of the design and practice of the pure Diesel engine will probably play a considerable part, and it may be expected that the lines of design of the Diesel and semi-Diesel engines will become more closely merged.

Practical difficulties would seem almost to confine the semi-Diesel engine to the two-stroke cycle. Developments towards improving the efficiency of scavenging may well be expected. In the United States of America semi-Diesel engines with separate scavenging pumps, crossheads, and so with forced lubrication, are already making their appearance.

The mean effective pressures developed by the semi-Diesel engine under conditions of continuous running are considerably less than those associated with the Diesel engine, due primarily to the questions of scavenging and compression already fully discussed. It is not expected that other than a slight increase in mean effective pressures can be looked for in the near future, since the simplicity of the semi-Diesel engine and its relatively low

compression pressure will probably be substantially retained. The low mean effective pressure in reducing heat stresses and temperature conditions within the cylinder makes for reliability in operation.

The vexed question of "solid" injection of the fuel becomes a simpler issue when associated with surface ignition. All considerations in the design of the fuel pump operating and controlling gear, and the injection means for semi-Diesel engines, have in the past been subservient to that of simplicity. With a demand for the same degree of flexibility, and a capacity to burn as wide a range of fuels, without recourse to the water drip, as obtains with the Diesel engine, considerable improvements after the war can confidently be anticipated.

Appendix I.—Mechanical Efficiency of Internal-Combustion Engines.—The following notes have special reference to internal-combustion engines of the trunk piston type; but apply equally, with slight modifications, for crosshead engines.

Mechanical efficiency (the ratio between brake horsepower and indicated horsepower) is affected by the number of auxiliaries which are driven by the main engine.

1. Except in so far as auxiliaries are concerned, the difference between the indicated horsepower and the brake horsepower can be apportioned as follows:

(a) 50 per cent is due to piston and piston-ring friction.

(b) 28 per cent can be attributed to main cylinder pumping losses, suction, exhaust and scavenging.

(c) 22 per cent is allocated to valve gear and bearing friction, etc., in which are included windage losses and other factors of little importance.

2. Piston friction depends primarily on the following factors:

(a) The quality of the metal of the liner, the piston and the piston rings.

(b) The quality of the lubrication. (Certain tests which have been carried out go to prove that a diminution in viscosity of oil increases the mechanical efficiency. In one case the mechanical efficiency was increased by water injection into the combustion chamber.)

(c) The clearance between the piston and the cylinder walls, has an influence on efficiency.

(d) The m. e. p. the compression pressure, and the pressure between the liner and the piston, and the liner and the piston rings, can probably have a most suitable value for the reduction of friction loss to a minimum.

(e) The fit and the condition of the piston rings.

(f) The temperature at which the engine runs will have an effect on the lubrication and on the clearance; and it has been substantially proved that there is a temperature of maximum mechanical efficiency.

3. The suction loss, 28 per cent of the total, is primarily a function of design of ports, valve setting, piston speed and gas speeds.

4. The valve gear and the bearings, 22 per cent of the total loss, will depend on the design of the engine, the alignment, the efficiency of the lubrication.

In addition to the foregoing, there are records of mechanical efficiency being reduced by increased weight of flywheel.

Generally, mechanical efficiency is adversely affected by increased speed and reduced m. e. p.; and decreased by mal-alignment, etc.

The mechanical efficiency may be affected by the form of the combustion chamber which may produce undue distortion of the piston working conditions, although this is probably extremely slight; distortion of the piston being more due rather to the condition of the gudgeon pin bearing than to any other cause.

The mechanical efficiency, assuming a constant m. e. p., is practically unaffected by the size of the engine.

In connection with the above, a large number of records of tests of engines have been investigated from Guldner, Supino, D. Clerk, etc.

Appendix II.—Reversibility.—Reversibility need only be discussed in relation to two-cycle semi-Diesel engines, since those working on the four-cycle principle have not, as yet, been made directly reversible. The compression of the scavenging air in the crank chamber fitted with automatic valves, and the operations of scavenging and exhaust within the working cylinder are directly reversible (see Fig. 2).

The only problem remaining is that of the timing of the injection of the fuel for the reverse direction of rotation. If the end of the delivery stroke of the fuel pump coincides with the top dead center of the main piston, no alteration in timing for fuel injection is required for astern running. This condition is satisfied in most of the multi-cylinder reversible semi-Diesel engines. However, should the timing of the fuel pump be such that the end of the delivery stroke does not coincide with the top dead center, then operating gears are necessary for the fuel pumps—one for ahead and one for astern—in an exactly similar manner to the arrangements adopted for Diesel engine cylinder head fuel injection valves with reversible marine engines.

The method adopted for changing the engine from the ahead direction of rotation to astern, may be:

(a) By means of a pre-injection and ignition of fuel.

(b) Pre-injection of starting air.

(c) Stopping the engine, reversing the driving mechanism of the starting air valves and possibly of the fuel pumps as well, and starting up the engine in the astern direction.

With (a) and (b) the fuel pump is timed so that the point of delivery coincides approximately with the top dead center of the main piston, and arrangements are made, that when the fuel is cut off, the engine is declutched, the speed falls to a predetermined minimum and an injection of fuel or starting air is effected by the governor on the up stroke of the piston, so driving it in the reversed direction. Method (c) is only applicable to four-cylinder engines, since engines with a lesser number of cylinders cannot be started from any position of the cranks at which the engine may have stopped. Although a clutch is generally fitted, it is not necessary for method (c). For a full description of method (c), see *Engineering* for August 24, 1917.—*Engineering*, 25/10.

AERONAUTICS

THE LIBERTY MOTOR.—*Its Checkered Career and Details of Its Construction.*—At last the restrictions of the censor have been lifted and we are able, without in any way giving aid or comfort to the enemy, to disclose to our readers pictures and drawings of that engine of mystery, the Liberty motor.

The career of this motor has been a checkered one. Announced first as a five-day creation, a masterpiece of ingenuity which could be turned out immediately in tens of thousands by typically American quantity production methods, it was loudly acclaimed as one of the greatest inventions of the war that would give America the mastery of the air. Then the pendulum swung to the opposite extreme. In the sharp reaction from this grossly exaggerated opinion of the Liberty motor, the machine was pronounced a pitiful failure, an immensely heavy brute with a voracious appetite for fuel, a mere automobile engine, absolutely unfitted to take on wings and soar among the clouds. It was now held up as a glaring example of inefficiency and incompetency. Ugly stories of graft were whispered about—of hundreds of millions of dollars absolutely thrown away. However, by the time the pendulum had reached that extreme the Liberty motor had passed through the long and tedious period of experimentation and preparation for quantity manufacture and it had undergone a thousand and one changes in minute details, all of which consumed a great deal of time, and when the public criticism had reached its highest tide this engine was already being turned out by at least one

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of the large manufacturing concerns in fairly large quantities and the daily production was steadily increasing.

It was on Thanksgiving Day, a year ago, that the first Liberty motor, built on an organized production basis, was wrapped in an American flag and shipped from the Packard plant to the aircraft forces. It was not until the following March that the Packard Company had organized its factory, produced the necessary tools and jigs, and completed the preparation for the production of the motor in quantity. This was the first large plant to undertake the manufacture of the Liberty motor. Five other plants began operations later and it was not until well along in the summer that production was proceeding at full capacity.

On the 21st of November, the Packard plant shipped its five thousandth Liberty motor, and there is every prospect that its entire order for 6000 motors will be completed well before Christmas Day. The Lincoln Motor Company also has a contract for 6000 motors; while the Ford Motor Company's contract calls for the construction of 5000; the Nordyke & Marmon Company for 3000 the General Motors Corporation for 2000, and the Trego Motor Company for 500, a total of 22,500 Liberty motors. Despite all criticism of delay and inefficiency, our country had 15,000 Liberty engines when the armistice was signed, all of which had been produced within eight months.

In the Senate report on the aircraft situation, as well as in the report of the Hughes investigation, it was declared that the Liberty motor had proved a decided success. To be sure, this motor is not adapted to all types of airplanes. Somehow, the public gained the notion that the Liberty motor would serve every purpose as an airplane power plant. As we pointed out very clearly many months ago, the Liberty motor, although one of the lightest, if not the lightest motor per horsepower, is entirely too heavy a machine for a light battleplane. It will be clearly evident to anyone who stops to consider that power is not the only requisite in an airplane, and a machine which carries an engine weighing over 800 pounds cannot possibly make the quick turns that are accomplished by a machine equipped with a 200- to 300-pound engine. The momentum of the engine will carry it forward despite the action the airplane's rudder, and it takes time to swing it from one direction to another. The Liberty motor, therefore, was never intended to be put in a small airplane with a single operator who aims his gun by steering his machine toward his target, but it is adapted for the larger machines which are used for bombing purposes, for observation, for reconnaissance, and also for the larger battleplanes, in which there is a machine-gun operator, as well as a pilot.

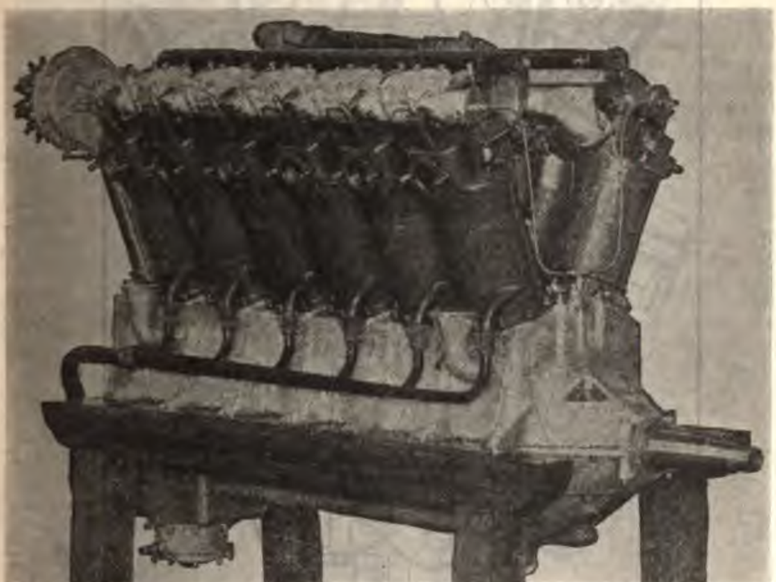
As we have stated in previous issues of the *Scientific American*, the Liberty motor weighs about 825 pounds. Its horsepower was raised during the development period from 367 to 450, and in some tests it has run up as high as 480.

In our story of the Liberty motor published in the issue of June 1 last, we showed that this engine was not designed in five days and that it was not a radically new invention. It was the result of a year and a half of experiment on the part of the Packard Company prior to the war, and in the famous five-day conference it was this engine which was modified to meet requirements of the government and then built very hastily within a month so that it could be delivered in Washington on Independence Day as the "Liberty" motor.

The original Liberty motor was fitted with eight cylinders, but this design was not accepted because word came from France that a motor of much higher power was needed, consequently the 12-cylinder type was decided upon. One of our photographs shows an 8-cylinder Liberty motor being tested out at the summit of Pike's Peake, in order to determine its operation under the rarified atmospheric conditions prevailing at that elevated spot. The motor was also tested out at sea level.

The first 12-cylinder Liberty motor was tested by mounting it on a large truck, as shown in one of our photographs, and driving the truck by means of an airplane propeller. This truck was propelled at speeds of over 40 miles per hour through the snow by means of this form of drive. On one occasion the brakes were set to lock the wheels, and yet the truck was moved bodily forward, with its wheels sliding along the ground, by the powerful thrust of the propeller. In our illustration it will be noticed that there is a nick in one of the blades of the propeller. This was produced by a bolt which was accidentally jarred off the truck and fell against the propeller blade. Because of the enormous speed of the propeller, this light piece of metal caused it to tear out a large piece of wood.

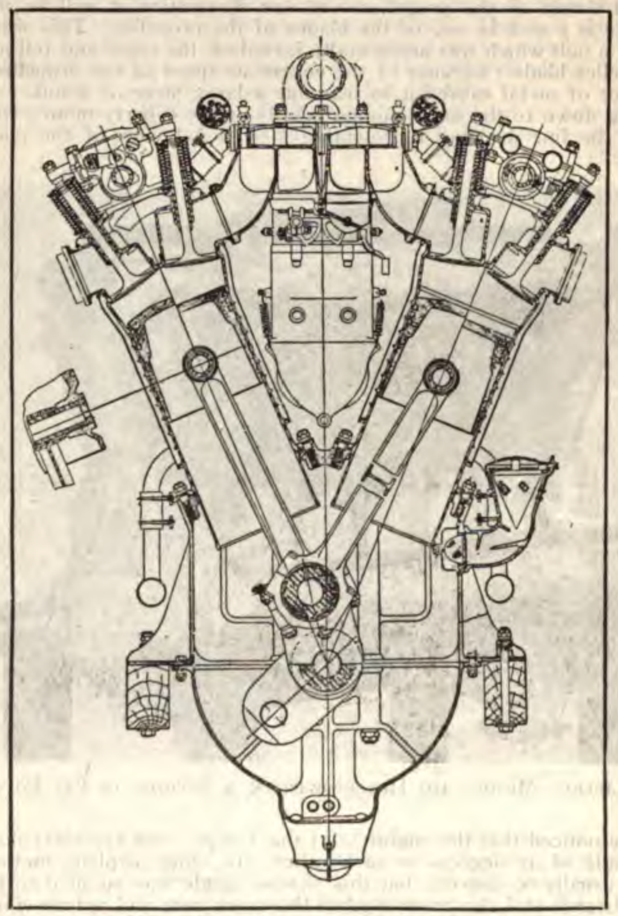
Coming down to the more minute details of the Liberty motor, we may refer to the line drawing representing a sectional view of the machine.



THE LIBERTY MOTOR—450 HORSEPOWER IN A WEIGHT OF 825 POUNDS.

It will be noticed that the engine is of the V-type, with cylinders disposed at an angle of 45 degrees to each other. In other airplane motors the angle is usually 60 degrees, but this sharper angle was adopted to reduce head resistance and also to strengthen the crank case and reduce vibration. The cylinders are of 5 by 7 bore and stroke and have a cubic capacity of 905 inches. The motor has individual cylinder barrels and stamped steel water jackets. This construction permits of machining the barrels all over so as to have uniformity of section and a maximum of strength with a minimum of weight. The stamped steel jackets insure uniform water space and absence of steam pockets. The jackets are welded to flanges formed on the cylinder, the cross sectional area of the flanges being the same as that of the jackets so that both members can be brought to an equal degree of temperature, thus facilitating the welding operation. The valves in the head are set at an angle to insure the best shape of combustion chamber and the maximum possible valve size. To shorten the

travel of the gases the inlet valves are on the inside, while the exhaust valves are on the outside and carry off the hot gases rapidly from the valves and motors. There is a single cam shaft for each set of cylinders which is mounted between the valve stems, providing a very simple and direct action. Double valve springs are used to minimize breakage from



CROSS-SECTIONAL VIEW OF THE LIBERTY MOTOR.

vibration. There are two duplex carburetors, each bore serving three cylinders so as to give the best distribution of gas and to permit of ready and accurate synchronization. Pressure lubrication is used on all plain bearings. The oil supplied to the connecting rod bearings and cylinders is controlled by metering conduits in the main and connecting rod bearings. The pistons are an aluminum alloy chosen for lightness and good heat-conducting properties. There are two spark plugs for each cylinder so as to halve the possibility of losing a cylinder due to spark plug trouble and in order to increase the rapidity of the flame propagation in the cylinders.

The future of the Liberty motor is a problem that is occupying a great deal of attention at the present time. It is not a power plant that can be used in automobiles or trucks. Its power is far greater than anything now required in such service. The motor might be used for racing motor boats, but it is distinctly an airplane engine built as an emergency measure for war purposes. No doubt a large stock of the motors now on hand will be retained by the government for the development of the air service of the army and navy which will have to be maintained on a large scale as long as the possibilities of war confront us. Airplanes will also be used in rapidly increasing numbers for postal service and no doubt to a considerable extent for pleasure, because the vast army of young men who have learned to navigate the air will not be content to remain on the ground. —*Scientific American*, 7/12.

SPEED AND HEIGHT RECORDS BY TWO-SEATER MONOPLANE.—The War Department authorizes the following:

Maj. Gen. Wm. L. Kenly has received information from Dayton, Ohio, that the Loening two-seater monoplane in recent tests there developed 145 miles per hour with full military load, including four guns, which is in excess of any record made by a European single-seater combat machine. The Loening plane in these tests also climbed 25,000 feet in remarkable time and carrying two passengers, thereby establishing another new record.

Air service officers here have watched the progress of this new plane in its tests with great interest. This monoplane is American designed and American built. Its construction embodies several new and original ideas. Smaller, of course, than the De Haviland 4, which is a bomber and reconnaissance machine, it weighs only about 2400 pounds loaded for the air, which is practically the weight of a single-seater scout. It is driven by an eight-cylinder, 300-horsepower Hispano-Suiza engine and the whole power plant is a unit construction and may be easily removed from the body of the plane. Several original ideas are also carried out in the understrutting, and the arrangement of the seats is such that the pilot has 50 per cent more vision than in any other combat machine produced before or during the war. The Leoning monoplane carries sufficient fuel for three and one-half hours.

Grover Cleveland Loening, the designer and builder, is an American. He has been an aeronautical engineer in this country for the last eight years, is the author of text-books used in study by American flying cadets, and has been given the degrees of bachelor of science by Columbia University and master of arts and civil engineer by New York University. His address is Loening Aeronautical Corporation, 45 West Eleventh Street, Long Island City, N. Y.—*Official Bulletin*, 3/12.

A NEW ITALIAN OBSERVATION BALLOON.—The chiefs of the aerostatic section of the Italian army, Major Avoria and Signor Prassove, Director of the Italian Army Aircraft Works, have produced a new type of observation balloon providing much more satisfactory results than the Parseval-Sigsfeld kite balloon or the trilobal Cacquot balloon, according to *L'Aeronauta*. The new type is essentially a spherical aerostat fitted with what are equivalent to stabilizing fins, and acting as a kite. It may be employed in winds of over 55 miles an hour, whereas the Parseval-Sigsfeld type could not be safely used in winds exceeding 12 miles an hour. The new type requires a smaller gas volume for equal load and owing to its smaller dimensions is easily transported and housed, while in flight it represents a smaller target to aircraft fire. A further advantage in the employment of mooring cables of small section follows from its smaller head resistance, while, should the mooring cable snap, the observation balloon may be operated as a free balloon.—*Scientific American*, 7/12.

SUBSTITUTE FOR GOGGLE GLASS.—It is understood that the Medical Research Board of the Division of Military Aeronautics has found a substi-

tute for glass for aviators' goggles. The substance, which is not glass, has been on the market for some time, although it has not hitherto been possible to cast it in the right strength and thickness for goggles. The substance is described as hard and non-inflammable, and is said to ensure practically a non-shattering lens.—*Scientific American*, 7/12.

NEW AMERICAN BATTLE MONOPLANE.—How fast America is reclaiming the aeronautical supremacy that was hers when the Wrights startled the world with their air expeditions is attested by the latest accomplishment. This is an American two-seater combat monoplane, designed and built by Grover Cleveland Loening, an American, and developed, as quite proper, in the "native habitat" of aero inventors, Ohio. The tests made at Dayton this week developed 145 miles an hour in speed, carrying four machine guns, which exceeds any European record by a machine of this type. The monoplane reached an altitude of 25,000 feet, carrying two passengers, another top mark. The machine weighs 2400 pounds, fully equipped, which is on a par with the single-seat scout planes used in the war. The motor is an eight-cylinder Hispano-Suiza, built in this country. The seating arrangements give the pilot fifty per cent more vision than any plane yet produced. It is much smaller than the de Haviland 4, with which the American fliers made aeronautical history on the west front in France, and its tank capacity is sufficient for three and one-half hours at maximum speed. Mr. Loening is head of an aeronautical corporation in Long Island City, N. Y., bearing his name. He is a bachelor of science, Columbia University; master of arts and civil engineer, New York University, and the author of text-books in use by American flying cadets. His invention is regarded as of great military importance by Major Gen. William L. Kenly, U. S. A., Director of Military Aeronautics.—*Army and Navy Journal*, 7/12.

CAPRONI'S PROPOSED 18,000-HORSEPOWER AIR CRUISER.—It was announced on November 11, at the annual meeting of the Aero Club of America, that Mr. Gianni Caproni, the famous Italian airplane constructor, is planning to construct an air cruiser of the heavier-than-air type with a number of motors aggregating 18,000 horsepower. The armistice having lifted the ban on the discussion of coming aeronautic developments, the Transatlantic Flight Committee of the Aero Club of America, of which Mr. Henry A. Wise Wood is chairman, made known the fact that there are several airplanes already being designed, each to be equipped with 5000 horsepower. Caproni has one such machine, and it was in connection with the discussion of this type that it became known that Caproni has an 18,000-horsepower air cruiser under consideration, which will be capable of carrying a large number of passengers in non-stop flights across the Atlantic. The famous British constructor, Handley-Page, is also planning to manufacture a 5000-horsepower machine, and similar plans are under consideration in the United States.—*Scientific American*, 7/12.

THE SEAPLANE.—At first glance, the giant seaplane of our navy appears formidable while resting on the water, and still more so when hauled up on shore where its boat-like body lies fully uncovered to view. In flight it does not seem so large; indeed, it might well be mistaken for the smaller flying boats by the layman, since all aircraft are deceptive while in flight. But viewed close up there can be no mistake about the size of this craft, with its 110-foot span, two Liberty motors developing from 400 to 500 horsepower each and driving propellers 10½ feet in diameter, and a body over 50 feet in length. The fact is that the body, or hull, is nothing short of a 50-foot yacht, but instead of velvet-cushioned berths and other comforts its interior is given over to a tangle of braces, wires, steering and controling devices, instruments, a wireless station, a six-station intercommunicating telephone system, fuel tanks and guns, all of which are the means of com-

bating the U-boat and of carrying out long-distance patrols at sea. On the water the seaplane develops a speed up to 50 miles an hour, and the moment it slips off the surface and soars upwards the speed increases to 100 miles an hour.

As in every other heavier-than-air machine, the naval aircraft engineers have had to secure strength in their structure while keeping a strict eye on the weight. Thus the required strength of every piece size consistent with the great strain to which they are subjected. The webs, but ¼-inch thick, are but little more than their name implies, sections being cut from the center and ends of each, leaving only a frame suggestive of thin slices of Swiss cheese. At intervals across the uncut portion of the webs are secured small battens, which are less than $\frac{1}{16}$-inch in thickness. Diagonal braces of piano wire, the tension of which is adjusted by turnbuckles, are stretched between the beams. Every part is carefully varnished as if for display and the whole covered by fabric stretched until it rings like a drum. The

NAVY FLYING BOAT.

strength is there, to be sure, but the weight is not; so that a 40-foot wing, eight feet in width, which appears to weigh at least a ton, is readily lifted by one man.

This same construction is followed in the entire seaplane. The keel is but little more than a strip of wood, but a perfect system of bracing makes it strong as a steel girder. Multiple-ply veneer measuring less than $\frac{3}{16}$-inch in thickness is used for planking and hull side covering. Brace wires and light tubular steel struts reinforce the entire structure. Every point not subjected to a direct strain is covered with fabric. Perfect materials and workmanship make the hull a canoe in weight and a torpedo-boat destroyer in size and strength.

There is no haphazard work about the building of one of these boats. Every piece of wood or metal is given an individual part number. Each one is designed for a particular place and the use of jigs and dies makes possible a degree of standardization of wood and metal parts which is as near perfect as can be reached in aircraft production.

The building of the boats is carried on in a series of progressive operations, each group of workmen having its particular part of the work to perform. Each man becomes an expert at his task and speed as well as excellence is attained.

Applying the Lesson of the Automobile Manufacturer.—Starting at the end of the huge shipbuilding hall, a hull is built from the laying of the main members of the skeleton or frame to the completed flying boat. By having a sufficient number of the frames in the different stages of construction, it is possible to send a completed hull out the door at the opposite end of the shop every day. The frames are built upside down up to a certain point, when they are turned right side up and the work continues to the finished hull. The frames are covered with thin veneer, marine glue, fabric and paint in forming the body of the huge seaplanes. While the hulls are being turned out the accompanying wings, tails, cable and other equipment are being produced in like manner so that they can all come together in the assembling plant.

Throughout, the progressive manufacturing methods are applied. It is possible to trace the progress of any given member of the seaplane from the crude to the finished product in the many departments of the great factory. Quantity production methods have been applied wherever feasible, but it is evident to the visitor that aircraft production calls for a vast amount of hand labor that cannot be replaced by machinery.

Six thousand separate and distinct pieces of wood are used in each seaplane. To hold these in place requires 50,000 wood screws and 46,000 nails, braces and tacks. Of veneer over 600 square feet is used, as well as 4500 square feet of cotton fabric of unusual strength which takes the place of the expensive Irish linen formerly associated with airplanes. The 250 pieces of tubing aggregate 1000 feet in length. To adjust the tension of the 5000 feet of wire and cable over 500 turnbuckles are required. About 1500 each of bolts, nuts and washers are needed to hold in place the 1000 metal strips and fittings which are used in the seaplane. And every piece, which in any respect varies in size or shape from another, has its part number.

Completed, as depicted in the headpiece illustration, one of the navy seaplanes weighs with its crew of five men about 14,000 pounds. It is generally equipped with one Davis non-recoil cannon and four Lewis guns, and has a cruising radius with its two motors and 500 gallons of gasoline of ten hours flight. Primarily its purpose is bombing, and four powerful depth bombs of 250 pounds each are suspended beneath its wings.

The work on the navy seaplane does not stop with the final assembly. There still remains the large task of disassembling its parts and boxing the complete outfit for overseas shipment. This work of packing includes not only the wings, ailerons, stabilizers, rudder, motors and propellers, but the hull as well. Three crates hold the seaplane being shipped, the principal and largest one, of course, being the one containing the hull. Next in size is the box holding the main panels, engine panel (the short, central section immediately over the motors), ailerons, and all accompanying struts, stay-wires and control cables. The third and smallest crate contains the tail section, consisting of the vertical and horizontal stabilizers, elevators, rudder and the braces, stays and cables required for their installation. The packing is done by a department that does nothing else. Seventy-five men are kept busy packing the huge seaplanes.

Changes in the present seaplane are being constantly evolved by the Engineering Experimental Department of the Naval Aircraft Factory. Altogether, they have first built three types of boats necessitating some 12,000 separate drawings and almost as many tests of material. One type of boat was designed, developed and built in 117 days. Another type was built and launched on schedule time, 111 days:

All changes are originally placed in the hands of the Experimental Section to develop, design and place on a manufacturing basis. Even after

the boat is completed, it is their problem further to perfect the separate parts. In the case of one design shipped to Europe, Admiral Simms, U. S. N., cabled 13 or 14 improvements. Seventy-five per cent of these had already been worked out by the Experimental Section and were then in production. The remaining were designed, built and installed within four days from receipt of the recommendations.

All in all, the Naval Aircraft Factory is a permanent institution to which we can turn both now and in the future for our naval aircraft needs.—*Scientific American*, 14/12.

MERCHANT MARINE

MERCHANT TONNAGE SUNK.—*World's Total During War Was 15,053-786 Gross Tons.*—The world's total losses of merchant tonnage from the beginning of the war to the end of October, 1918, by enemy action and marine risk was 15,053,786 gross tons, according to official announcement issued to-night.

During the same period vessels totaling 10,849,527 tons were constructed and enemy tonnage totaling 2,392,675 was captured, making a net loss of tonnage during the war of 1,811,584.

British merchant tonnage losses were 9,031,828 gross tons from the beginning of the war to October 31, 1918. New construction in the United Kingdom in the same period was 4,342,296; purchases abroad were 530,000 tons, and enemy tonnage captured was 16,520. The net loss was 3,443,012 tons.—*Washington Evening Star*, 6/12.

TURBINE-PROPELLED VERSUS MOTOR-DRIVEN VESSELS.—In a review of shipbuilding developments in the Scandinavian countries, London *Engineering* observes that turbine-propelled vessels are also attracting increased attention, and their advocates think they will be the most serious competitors of motor-driven vessels. In this respect also Norway is well to the fore, and a new type, the so-called Brodin type, was launched the other day from the Frederikstad shipyard, Norway, it being christened the *Arcturus*. The dimensions are 300 feet length, 47 feet breadth, depth 23 feet, and draft 19 feet, 9 inches, 4600 tons, deadweight. The special feature is connected with the location of the ship propelling machinery, the boilers, bunkers, and the turbo-electric driving seats—two turbo-generators of 600 i. h. p., each, generating three-phase current—are placed amidships, while the motors and gearing are placed aft, the current transmission being by cables. This arrangement ensures a saving in space, resulting in an increased cargo capacity of about 100 tons, in addition to which the consumption of coal is claimed to be smaller, by about 200 tons, than in a vessel propelled by ordinary steam engines. This means a 200-ton deadweight increase in loading capacity. At the trial trip a speed of eleven knots was reached. The consumption of coal was guaranteed at 0.45 kg. best East Coast coal per indicated horsepower per hour, and this condition was fully complied with. The Frederikstad yard has orders in hand for 25 vessels of this type.—*Nautical Gazette*, 30/11.

MISCELLANEOUS NOTES

THE SECRET OF THE "BABY" TANK.—It will always remain a troublesome feature of military writing that the most interesting things cannot be described in full until they have ceased to be timely. A month past, when battles were still raging on the fields of France, a drawing of the interior details of a small French tank would have been most opportune, since hundreds of these weapons were being used by the French and the Americans. But military exigency precluded the presentation of such material for the very reason that it was then too opportune and too interesting—particularly to the enemy. So it remains for us to publish details

of this kind from time to time as they are released by the military authorities, even if hostilities have been brought to a close

The small tank shown in the accompanying drawing and photograph represents the outcome of improved tank tactics. These tactics, which have been been covered at length in a number of articles appearing in these columns for several months past, caused the abandonment of the heavier and larger British and French tanks in favor of the smaller type. Thus the big allied tanks, weighing in the neighborhood of 25 tons and carrying a crew of eight to ten men, were replaced early this year by the "Whippet" tanks of the British and the "Renault" tanks of the French, both these types being small, two-man tanks, carrying a single machine gun or small cannon as compared with the four to six guns of the larger tanks.

Tank tactics are now based on the perfect coördination between tanks and infantry; and with the older, slower moving tanks it was found well-nigh impossible to keep these two arms moving in perfect unison. Again, the early tanks were cumbersome, difficult to maneuver, and withal, presented a more than fair mark to enemy gunners. Because of their size and the large crews required, the number of tanks available for an attack

SECTIONAL VIEW OF THE RENAULT OR SO-CALLED "BABY" TANK EMPLOYED BY THE FRENCH AND AMERICAN ARMIES IN THE CLOSING BATTLES OF THE GREAT WAR.

was strictly limited. Furthermore, in actual practice the power of the tank and its ability to crush enemy defences were found to be of secondary value only, since the main object is to carry guns, ammunition, and the crew.

It remained for Louis Renault of Billancourt, France, to develop a fast "Baby" tank to meet the new requirements. This he did, and fleets of his tanks made their appearance this spring, shortly after their counterparts, the British "Whippets," had scored new victories against the enemy. The Renaults were a success from the start, being adopted by the French army and later by the American forces fighting in France.

The Renault tank, as will be noted in the accompanying illustrations, consists primarily of an elongated armored body measuring about 13 feet in length, 6½ feet in height, and a trifle over a yard in width, equipped with a set of caterpillar treads and a power plant. The armor varies from ⅕- to ⅗-inch in thickness, and is of a special chrome steel plate, capable of withstanding small-arms fire and the burst of small shells. The body is surmounted by a revolving turret which carries the single machine gun

or the 37 mm. (1½-inch) cannon, with which the tank is armed. Some Renaults are provided with a short-barrel 75 mm. (3-inch) cannon, in which case the turret is rigid.

The interior of the Renault tank is divided into two compartments—one for the crew and the other for the power plant. At the forward end sits the driver, with his feet resting on two of the three pedals which control the clutch, brake and accelerator. Three levers are close at hand, controlling the speed and the operation of each tractor belt. Standing immediately back of the driver is the gunner, who operates the gun in the revolving turret. A wide belt of strap serves as a seat for the gunner, who can turn the revolving turret and its gun to any point. Narrow slits, measuring ⅛-inch wide, afford sufficient vision for the driver and the gunner. Entrance to the tank is afforded by the opening of doors immediately in front of the driver's post. An emergency door is also available in the turret.

In the rear compartment is located the Renault engine, fuel tank, and oil tank; the radiator, which receives a constant stream of cold air by means of a special ventilator; and the other members of the power plant. The crank handle for starting the engine extends into the forward compartment, directly behind the gunner.

As for the caterpillar system, it is quite conventional in these days of farm tractors. The power of the engine is transmitted through a pair of large sprocket wheels to the belts, and the endless belts are supported by a system of idlers, rollers and springs as depicted in the photograph. For steering, the familiar method of varying the belt operation is followed; that is to say, if the tank is to turn to the right, for example, the right belt is disengaged from the power plant, whereupon the tank swings around the idle right belt which then acts as a pivot.

The little monster weighs in the neighborhood of 7 tons with its full equipment. It develops a speed of between six and seven miles on hour. While not as formidable a vehicle as the larger tanks, to be sure, the Renault readily shatters all forms of barbed-wire entanglements and solid brick walls.

As for the gymnastic feats of the Renault tank, it is reported that owing to the high tractive effort developed by its belts, together with the judicious placing of the center of gravity, it will climb a 120 per cent grade, or in the neighborhood of a 50 degree incline. This tank will pass through water 3 feet in depth. And because of the pointed front and the queer tail appendage, the Renault is perfectly at home in any sort of shell-torn terrain. It is seldom that such a tank becomes stuck or stalled even on the roughest journeys; about all that can happen to it is to topple over on its side when a mine or shell bursts close by and creates a crater, and then it is readily righted and again started on its way.—*Scientific American*, 30/11.

DIARY OF THE WAR

1914

June 28.—Francis Ferdinand shot at Sarajevo.

July 5.—Kaiser's War Council at Potsdam.

July 23.—Austro-Hungarian Note to Serbia.

July 28.—*Austria declared war on Serbia.*

July 31.—State of war in Germany.

Aug. 1.—*Germany declared war on Russia.*

Aug. 2.—German ultimatum to Belgium.

Aug. 3.—*Germany declared war on France.*

Aug. 4.—*Great Britain declared war on Germany.*

Aug. 10.—*France declared war on Austria.*

Aug. 12.—*Great Britain declared war on Austria.*

Aug. 15.—Fall of Liége.

Aug. 16.—*British Army landed in France.*
Aug. 20.—Germans occupied Brussels.
Aug. 23.—*Japan declared war on Germany.*
Aug. 24.—Fall of Namur.
Aug. 25.—Sack of Louvain.
Aug. 26.—Battle of Tannenberg.
Aug. 28.—*British Victory in the Bight.*
Aug. 29.—New Zealanders in Samoa.
Sept. 2.—Russians took Lemberg.
Sept. 3.—Paris Government at Bordeaux.
Sept. 5.—*End of Retreat from Mons.*
Sept. 6.—First Marne Battle Begun.
Sept. 15.—First Aisne Battle begun.
Sept. 16.—Russians evacuated East Prussia.
Sept. 23.—First British Air Raid in Germany.
Oct. 9.—Fall of Antwerp.
Oct. 13.—Belgian Government at Havre.
Oct. 20.—*First Battle of Ypres begun.*
Nov. 1.—Naval Action off Coronel.
Nov. 5.—*Great Britain declared war on Turkey.*
Nov. 7.—Fall of Tsingtau.
Nov. 10.—***Emden* sunk.**
Nov. 21.—British occupied Basra.
Dec. 2.—Austrians in Belgrade.
Dec. 8.—*Naval Battle off the Falklands.*
Dec. 14.—Serbians retook Belgrade.
Dec. 16.—Germans bombarded W. Hartlepool.
Dec. 18.—Hussein Kamel, Sultan of Egypt.
Dec. 24.—First Air Raid on England.

1915

Jan. 24.—*Naval Battle off Dogger Bank.*
Feb. 2.—Turks defeated on Suez Canal.
Feb. 18.—U-Boat "Blockade" of England.
Feb. 25.—*Allied Fleet attacked the Dardanelles.*
Mar. 10.—British captured Neuve Chapelle.
Mar. 22.—Russians took Przemysl.
Apr. 22.—*Second Battle of Ypres begun.*
Apr. 25.—*Allied Landing in Gallipoli.*
May 3.—Battle of the Dunajec.
May 6.—Battle at Krithia, Gallipoli.
May 7.—*Lusitania* torpedoed.
May 8.—Germans occupied Libau.
May 11.—German repulse at Ypres.
May 12.—General Botha occupied Windhuk.
May 16.—Russian Retreat to the San.
May 23.—*Italy declared war on Austria.*
May 25.—*Coalition Cabinet formed.*
June 2.—Italians crossed Isonzo.
June 3.—Russians evacuated Przemysl.
June 22.—Austro-Germans recaptured Lemberg.
July 2.—Pommern sunk in Baltic.
July 9.—German Southwest Africa conquered.
July 24.—Nasiriyeh, on Euphrates, taken.
Aug. 4.—Fall of Warsaw.
Aug. 5.—Fall of Ivangorod.
Aug. 6.—*New Landing at Suvla Bay.*
Aug. 8.—Gen. Birdwood's advance at Anzac.
Aug. 9.—British success near Hooge.
Aug. 15.—National Registration.
Aug. 17.—Fall of Kovno.
Aug. 18.—Russian victory in Riga Gulf.
Aug. 19.—Fall of Novo-Georgievsk.
Aug. 21.—Cotton declared contraband.
Aug. 25.—Fall of Brest-Litovsk.
Sept. 1.—Gen. Alexeieff as Chief of Staff.
Sept. 2.—Fall of Grodno.
Sept. 5.—Tsar as Generalissimo.
Sept. 7.—Russian victory near Tarnopol.
Sept. 18.—Fall of Vilna.
Sept. 21.—Russian Retreat ended.
Sept. 25.—*Battle of Loos and in Champagne.*
Sept. 28.—Victory at Kut-el-Amara.
Oct. 4.—Russian ultimatum to Bulgaria.
Oct. 5.—Allied landing at Salonika.

Oct. 6.—Austro-German invasion of Serbia.
Oct. 9.—Belgrade occupied.
Oct. 14.—*Bulgaria at war with Serbia.*
Oct. 17.—Allied Note to Greece.
Oct. 19.—Lord Derby on the 46 Groups.
Oct. 22.—Bulgarians occupy Uskub.
Oct. 28.—M. Briand French Premier.
Nov. 5.—Fall of Nish.
Nov. 22.—Battle of Ctesiphon.
Nov. 29.—British withdrew from Ctesiphon.
Dec. 2.—Fall of Monastir.
Dec. 3.—General Townshend at Kut.
Dec. 9.—Allied retreat in Macedonia.
Dec. 13.—Salonika lines fortified.
Dec. 15.—*Sir D. Haig C.-in-C. in France.*
Dec. 19.—Withdrawal from Gallipoli.
Dec. 25.—Turkish defeat at Kut.

1916

Jan. 8.—Gallipoli evacuation complete.
Jan. 13.—Fall of Cettigne.
Feb. 9.—General Smuts appointed to E. Africa.
Feb. 16.—Russians entered Erzerum.
Feb. 18.—German Kamerun conquered.
Feb. 21.—*Battle of Verdun begun.*
Feb. 24.—Germans took Ft. Douaumont.
Mar. 16.—Admiral von Tirpitz dismissed.
Apr. 9.—German assault at Verdun.
Apr. 17.—Russians entered Trebizond.
Apr. 24.—Rebellion in Ireland.
Apr. 29.—*Fall of Kut-el-Amara.*
May 24.—British Conscription Bill passed.
May 31.—*Battle of Jutland.*
June 4.—General Brusiloff's offensive.
June 5.—Lord Kitchener lost at sea.
June 14.—Allied Economic Conference in Paris.
June 21.—Mecca taken by Grand Sherif.
July 1.—*Somme Battle begun.*
July 25.—Russians occupied Erzinjan.
Aug. 6.—Italian offensive on Isonzo.
Aug. 10.—Russians at Stanislau.
Aug. 27.—*Rumania entered the War.*
Aug. 29.—Hindenburg Chief of Staff.
Sept. 3.—Zeppelin destroyed at Cuffley.
Sept. 26.—British took Thiepval and Combles.
Oct. 10.—Allied Ultimatum to Greece.
Nov. 1.—Italian Advance on Carso.
Nov. 13.—British Victory on the Ancre.
Nov. 18.—Serbians and French took Monastir.
Nov. 29.—*Grand Fleet under Sir D. Beatty.*
Dec. 1.—Anti-Allied Riot in Athens.
Dec. 5.—*Resignation of Mr. Asquith.*
Dec. 6.—Germans entered Bukarest.
Dec. 7.—*Mr. Lloyd George Prime Minister.*
Dec. 12.—German "Peace Proposals."
Dec. 15.—French Victory at Verdun.
Dec. 20.—President Wilson's Peace Note.

1917

Jan. 1.—Turkey denounced Berlin Treaty.
Feb. 1.—*"Unrestricted" U-Boat War begun.*
Feb. 3.—*America broke with Germany.*
Feb. 6.—British captured Grandcourt.
Feb. 24.—British took Kut-el-Amara.
Mar. 11.—British entered Baghdad.
Mar. 12.—*Revolution in Russia.*
Mar. 15.—*Abdication of the Tsar.*
Mar. 18.—British entered Péronne.
Mar. 21.—First British Imperial War Cabinet.
Apr. 6.—*America declared war on Germany.*
Apr. 9.—*Battle of Vimy Ridge begun.*

May 4.—French took Craonne.
May 14.—New Italian offensive.
May 15.—General Pétain French Commander-in-Chief.
June 7.—British victory at Messines Ridge.
June 12.—Abdication of King Constantine.
June 26.—First American Troops in France.
June 27.—Mesopotamia Report issued.
June 29.—General Allenby commander in Egypt.
July 1.—Last Russian offensive begun.
July 14.—Bethmann Hollweg dismissed.
July 17.—British Royal House styled "Windsor."
July 19.—Reichstag "Peace" Resolution.
July 24.—Russian defeat in Galicia.
July 31.—Great Allied attack around Ypres.
Aug. 29.—President Wilson's Note to the Pope.
Sept. 4.—Germans occupied Riga.
Sept. 15.—*Russian Republic proclaimed.*
Sept. 28.—British victory at Ramadieh.
Oct. 9.—Allied attack in Flanders.
Oct. 24.—*Italian defeat at Caporetto.*
Oct. 29.—Fall of Udine.
Oct. 30.—Chancellor Michaelis dismissed.
Oct. 31.—British captured Beersheba.
Nov. 1.—German retreat on Chemin de Dames.
Nov. 4.—British troops in Italy.
Nov. 6.—*British stormed Passchendaele Ridge.*
Nov. 7.—British captured Gaza.
Nov. 8.—*Bolshevist coup d'état in Russia.*
Nov. 9.—Italian stand on the Piave.
Nov. 17.—British in Jaffa.
Nov. 18.—Gen. Maude's death in Mesopotamia.
Nov. 20.—British victory at Cambrai.
Nov. 30.—German reaction at Cambrai.
Dec. 6.—Armistice on Russian Front.
Dec. 9.—British captured Jerusalem.
Dec. 22.—*Brest Conference opened.*
Dec. 26.—Sir R. Wemyss First Sea Lord.

1918

Jan. 5.—Mr. Lloyd George on War Aims.
Jan. 20.—*Breslau* sunk: *Goeben* damaged.
Feb. 1.—Germany recognized Ukraine.
Feb. 9.—*First Brest Treaty Signed.*
Feb. 16.—Gen. Wilson Chief of Staff.
Feb. 18.—German invasion of Russia.
Feb. 21.—*British capture Jericho.*
Feb. 24.—Turks recovered Trebizond.
Feb. 25.—Germans at Reval.
Mar. 3.—*Second Brest Treaty.*
Mar. 7.—German peace with Finland.
Mar. 11.—Turks recovered Erzrum.
Mar. 13.—Germans at Odessa.
Mar. 14.—Brest Treaty ratified at Moscow.
Mar. 21.—German offensive in the West.
Mar. 24.—Bapaume and Péronne lost.
Apr. 5.—Allied landing at Vladivostok.
Apr. 9.—New Military Service Bill.
Apr. 11.—Armentières lost.
Apr. 13.—Turks occupied Batum.
Apr. 14.—*General Foch, Allied Generalissimo.*
Apr. 15.—Bailleul lost.
Apr. 18.—Lord Milner War Secretary.
Apr. 22.—*Naval raid on Zeebrugge and Ostend.*
Apr. 26.—Kemmel Hill lost.
Apr. 27.—Turks occupied Kars.
Apr. 30.—Germans at Viborg.
May 1.—Germans at Sebastopol.
May 9.—Second Raid on Ostend.
May 27.—*Second German Offensive.*
May 29.—Soissons lost; Reims held.
May 31.—*Germans reached Marne.*
June 1.—Attacks towards Paris held.

June 9.—New German Assault.
June 15.—Austrian Offensive in Italy.
June 23.—Great Austrian Defeat.
July 2.—1,000,000 Americans are shipped to France.
July 6.—American attack near Chateau Thierry.
July 15.—*Third German Offensive. Second Marne Battle begun.*
July 16.—Ex-Tsar shot at Ekaterinburg.
July 18.—*General Foch's counter-attack.*
July 20.—Germans recrossed the Marne.
Aug. 2.—Soissons recovered.
Aug. 8.—British attack at Amiens.
Aug. 29.—Bapaume and Noyon regained.
Sept. 1.—Péronne recovered.
Sept. 2.—*Drocourt-Quéant line breached.*
Sept. 12.—American attack at St. Mihiel.
Sept. 15.—Austrian Peace Note.
Sept. 17.—New Macedonian offensive.
Sept. 19.—British advance in Palestine.
Sept. 25.—Bulgaria proposed armistice.
Sept. 27.—*Hindenburg line broken.*
Sept. 29.—*Bulgaria surrendered.*
Sept. 30.—*Fall of Damascus.*
Chancellor Hertling resigns.
Oct. 1.—St. Quentin regained.
Oct. 4.—Abdication of King Ferdinand.
Oct. 9.—Cambria regained.
Oct. 10.—British took Le Cateau.
Oct. 13.—French recovered Laon.
Oct. 14.—British troops at Irtkutsk.
Oct. 15.—British in Homs.
Oct. 17.—*Ostend, Lille, Douai regained.*
Oct. 19.—Bruges reoccupied.
Oct. 20.—Belgian Coast Clear.
Italian offensive on Piave.
Oct. 25.—Ludendorff resigned.
Oct. 26.—Aleppo fell to the Allies.
Oct. 27.—Austria sued for Peace.
Oct. 28.—Italians crossed Piave.
Oct. 29.—Serbians reached the Danube.
Oct. 30.—*Turkey granted Armistice.*
Nov. 1.—*Versailles Conference Opened.*
Nov. 2.—British at Valenciennes.
Nov. 3.—Austrian Surrender. Kiel Mutiny.
Nov. 4.—Versailles Armistice Agreement.
Nov. 5.—Full Powers for Marshal Foch.
Wilson's Last Note to Germany.
Nov. 6.—Americans reached Sedan.
Nov. 7.—Bavarian Republic Proclaimed.
Nov. 9.—Foch received German Envoys.
Abdication of the Kaiser.
Chancellor Prince Max resigned.
Berlin Revolution.
Nov. 10.—Kaiser's flight to Holland.
British at Mons.
Nov. 11.—*Armistice Terms Accepted.*

—*London Times*, 12/11.

LESSONS OF THE WAR

THE BATTLE OF JUTLAND.—Simultaneously with the surrender of the German fleet off the Firth of Forth, Scotland, Captain Persius, the well-known German critic, made some astonishingly candid admissions regarding the decisive character of the defeat which was administered to the German High Seas fleet by the British Grand fleet in the Battle of Jutland.

It is characteristic of the wholesale deception practiced upon the German nation by its rulers that the Kaiser should have announced the defeat at Jutland as a glorious victory for the German Navy—a lie which was industriously distributed by German propagandists throughout the world, and notably in this country.

The first doubts as to the condition of the German fleet were aroused by the fact on the fleet's return to Kiel and Wilhelmshaven, the navy yards at these ports were tightly closed and no civilian was allowed to enter. This doubt increased as the months and the years went by and the German fleet made no second attempt to dispute the mastery of the seas.

The losses by actual sinking of ships of the German fleet are now proved to be just those which were positively claimed by Admiral Jellicoe in his report of the battle. But it will be remembered that he spoke of some three or four capital ships, which had come under heavy gunfire and were so badly listed or on fire, that their sinking before they could be brought back to port was considered to be inevitable. These vessels were very badly smashed up indeed; but, thanks to the most excellent subdivision and general under-water protection which is incorporated in the German ships, they evidently managed to limp back to a home port for repairs.

There used to be a saying among our naval officers that the landing of the first successful heavy gun salvo would probably win the fight, meaning that if the ten or twelve big shells "straddled" the enemy ship, the destruction wrought would be so great, both upon personnel and upon the complicated structure and gear of the ship, that she would be heavily handicapped for the rest of the fight.

Now in his report, Admiral Jellicoe stated that his own flagship, the *Iron Duke*, registered on a ship of the *Kaiser* class, and placed several successive straddles across her. Another of his ships, according to his report was able to hold the range long enough to straddle on another German ship with six successive salvos. Now the shooting was done with 1400-pound, 13.5-inch high-explosive shells. The damage done must have been most serious, and Captain Persius now tells the world that "the losses of the German fleet were enormous, and that it was clear to every thinking man" on that day "that the Skagerrak battle must be the only general naval engagement of the war. His article in the Berlin *Tageblatt* goes on to say that "the German fleet was saved from destruction partly by good leardership and partly by favorable weather conditions. Had the weather been clear or Admiral von Scheer's leadership less able, the destruction of the whole German Navy would have resulted. The long-range British gun, he says, would have completely smashed the lighter-armed German ships."

The honor of the fight lay with Admiral Beatty, who did not hesitate to bring his armored cruisers under the fire of the German battleships, in his determination to hold the enemy until the British battleship fleet could come up and get into action. This initiative, skill and courage, in spite of the loss of three of his battle cruisers gained for him the supreme command of the Grand fleet and the honor of receiving, three years after the battle of Jutland, the surrender of the enemy against which he fought on that memorable day.—*Scientific American, 7/12.*

CONVOY SYSTEM'S SUCCESS.—The following table gives statistics of vessels in organized convoy up to October 26, 1918, inclusive:

Convoy. Atlantic convoys. Homeward	No. of convoys	No. of merchant ships	Losses in convoy	P. C.
North Atlantic	306	5,416	40	0.74
Gibraltar	133	1,979	30	1.5
West African ports	105	944	6	0.64
Rio de Janeiro	22	307	1	0.32
Total	566	8,646	77	0.89
Outward				
Various sailings from British ports	508	7,110	45	0.63
Other convoys				
Scandinavian (old system)	...	6,475	75	1.15
Do. (new system)	...	3,923	16	0.41
French coal trade	...	37,221	53	0.14
Local Mediterranean	...	10,275	127	1.24
East Coast	...	12,122	40	0.33
Grand total	...	85,772	433	0.51

STATEMENT OF SHIPS IN ORGANIZED ATLANTIC CONVOYS
July 26, 1917–October 5, 1918

SHIPS

	Homeward bound	Outward bound	Total
Convoys	539	488	1,027
Ships convoyed	8,194	6,774	14,968
Casualties	74	44	118
Per cent of casualties	0.9	0.65	0.79

TONNAGES
(Gross Deadweight)

	Homeward bound	Outward bound	Total
Convoyed	59,062,200	47,491,950	106,554,150
Lost	510,600	378,100	888,700
Per cent of losses	0.86	0.8	0.83

(Gross Tonnage)

Convoyed	43,196,740	33,860,491	77,057,231
Lost	364,842	289,446	654,288
Per cent of losses	0.84	0.85	0.85

NOTE.—The above figures and the casualties only refer to convoys which reached their destination on or before October 5, 1918, and do not include convoys en route at that date.

WORLD'S DAILY AVERAGE LOSS OF SHIPPING

Quarter	No. of vessels	Gross tons
1st quarter, 1917	7.6	16,530
2d quarter, 1917	10.43	23,550
3d quarter, 1917	6.22	15,270
4th quarter, 1917	5.04	12,500
1st quarter, 1918	4.50	10,740
2d quarter, 1918	3.37	8,600
3d quarter, 1918	2.91	7,813

—*Nautical Gazette*, 30/11.

TRUTH ABOUT THE U-BOATS.—*Steadily Diminishing Sea Strength.*—Captain Persius, in the *Berliner Tageblatt*, says that many cherished the hope that the German Grand fleet would fight a second Skager Rak Battle, and that its submarines would bring England down. These sanguine people were blinded by the lies which were one of the principal weapons of German land and sea warfare.

The celebrated orgies under Tirpitz and Capelle were bluff. People did not know that for a year there had been no German High Seas fleet, even to a limited extent, and that submarine forces worthy of the name only existed in the mouth of the heads of the fleet.

He says that Grand Admiral Tirpitz's mistaken construction policy was responsible for Germany's defeat. Admiral von Scheer's capable command, Admiral Jellicoe's bad leadership, and the thick weather saved Germany from disaster at Skager Rak, otherwise the longer range of the British guns would have inflicted a crushing defeat on the German fleet. German losses, despite this luck, were frightful, and on June 1 it was clear to all acquainted with the situation that this battle would be the only one. Authoritative quarters openly said this.

After September, 1917, useless warship construction was abandoned by order, not of the naval but of the army authorities. Material for the construction of submarines was then so scarce that the boats of line ships had to be used. Twenty-three line ships were withdrawn from the navy in this way in 1918, including the *Deutschland*, eight coast armored vessels, three armored cruisers, five cruisers of the *Hansa* class, the small cruiser *Strassburg*, and 15 other cruisers; thus in 1918 the High Sea fleet consisted only of dreadnoughts, line ships of the *Dessau, Helgoland, Kaiser*, and *Markgraf* class, and some line cruisers.

When the ruthless submarine war was declared there were hardly any submarines. Hardly any were built under Admiral Tirpitz, while Admiral von Capelle constructed only a few. They would only have been completed, as far as larger boats were concerned, in 1919 and 1920. The official assertion that losses were fully covered by new construction was untrue. The following table shows the construction and losses in 1917, the first figure in each case representing the number built and the second figure the number lost:

January, 6 and 4	July, 10 and 4
February, 3 and 3	August, 12 and 11
March, 4 and 6	September, 8 and 1
April, 4 and 1	October, 12 and 12
May, 6 and 5	November, 5 and 7
June, 8 and 3	December, 5 and 9

The number of submarines (" front boats ") was as follows in the months stated:

1917		1918	
April	126	January	133
July	134	February	136
August	134	April	128
October	146	June	113
December	137		

Only a small percentage of " front boats " have been in action. In January, 1917, when circumstances were favorable, 12 [? 32] per cent of the submarines were at the front, 30 per cent in port, and 38 per cent testing and exercising. During the war the submarines suffered severely, the crews, often insufficiently trained, had no longer the necessary confidence in their arm, and consequently there was latterly very little inclination for this dangerous service, especially as experienced seamen clearly saw that all the sacrifice was in vain. The same applies to the full sea fleet, the crews realizing that if battle was given it meant, having regard to the small number of ships available, the useless sacrifice of a large number of valuable lives. They therefore protested, and every sensible man will be thankful that they did. By their action on November 5 they rendered the nation incalculable service.—*London Times*, 23/11.

WHAT IS VICTORY?—*II.—By Arthur Pollen.*—It was suggested that the position at sea could not be established satisfactorily after the war unless three essential terms of peace were made operative. They were: the restitution by Germany of the merchant tonnage destroyed, the assignment of the German colonies with their seaports to a non-German power, and ordinances and guarantees that Germany should not possess submarines now or in the near future. It was also suggested that the submarine might by consent be made contraband of humanity, and if not made contraband, at any rate eliminated finally as an instrument for the exercise of the rights of search and capture. But the essential matter is the tonnage, the colonies, and Germany's final deprivation of under-water instruments of war. There are, however, further points which are partly naval, partly territorial, and partly military. The fate of the High Seas Fleet need not delay us in this connection, as this is part of the general question of the enemy's disarmament.

Heligoland: the Baltic: the Dardanelles.—So I pass on to the problems of the closed seas and Heligoland. As to this last, the folly of 1892 must certainly be undone. In a moment of fatal blindness we then ceded to Germany an island to which our moral title was of the slenderest, in exchange for certain rights in Africa to which Germany had no title at all. The possession was, indeed, of no positive value to us at that time, nor, for that matter, to Germany, for it did not appear in 1892 that there was anything in German world policy that would bring her into conflict with a naval power. The singular thing about the attitude of mind of British statesmen at that time was their blindness to the very obvious fact that the real value of Heligoland to Germany would come when Germany was at war with England. Well, we have survived the war and the folly which gave our enemy this quite priceless advantage; but we must see to it that it cannot once more be used against us. In a sense, the most satisfactory arrangement would be to return it to its original owners, the Danes; but it clearly must come out of German hands, and it is possible that if restored to Denmark, its seizure by Germany in time of war could not be prevented. However this may be, it must be German no longer. The questions of the Baltic and the Black Sea are more complex. The entrances to the Black Sea have long been dominated by the power possessing the land on either side of the very narrow straits leading in and out of the Sea of Marmora, but modern armament would enable Sweden and Denmark to close the Baltic as effectually. It is more to the point that any considerable naval power on the Baltic side of the sound could make penetration through the narrow waters of the Danish Islands into the Baltic extraordinary dangerous without any obvious breach of Danish neutrality, while the seizure of the islands after a fleet had penetrated would, of course, cut their communications completely. It was for this reason that it was said that the problem of sending a British fleet into the Baltic was not naval, but military. If Germany retains her present naval force and her monopoly of the Kiel Canal she would still be able to control the sea communications of Russia and Finland absolutely, except for such alternative means as Kola Bay affords. But Kola is very distant from the centers of Russian industry, so that its employment would be exceedingly uneconomical in peace time, though of vital value in war. What the Allies have to do is to see that German domination of the Baltic cannot be re-asserted at any time, just as they must also see that Turkish domination of the Black Sea, by her possession of the only exit from it, is terminated also. But in the case of the Baltic the position of Germany is far stronger than that of Turkey, for if a power commanding Gallipoli and the Asiatic shore can make it impossible for a hostile navy to force a passage past the narrows, it is also true that a hostile navy can make it almost impossible for any Turkish fleet to leave the Dardanelles. But Germany is in no such difficulty. The possession of the Kiel Canal gives her a perfectly protected communication with the North Sea, so that if no powerful fleet threatens her in the Baltic, that sea must become a German lake. It is neither to the interest of ourselves, nor of any of the new states, Finland, Poland, and regenerated Russia, that are now coming into being, that this state of things should continue. Means must, therefore, be found of denationalizing the waterway and putting it under international control.

Summary of Imposed Conditions.—We can now group the conditions of peace into three. There are, first, those which satisfy the punitive and retributive sides of justice. These conditions are, first, the punishment of those guilty of atrocities; secondly, the surrender of conquered territories and the restitution of stolen goods; thirdly, the payment for or replacement of stolen property, buildings, churches, factories, and particularly of ships; and, lastly, the indemnification of those who have either themselves suffered personal injuries, or whose relatives have been murdered or tortured into incapacity.

These four requirements of punitive and retributive justice call for the performance of certain tasks by Germany, and the performance of these tasks must be guaranteed.

We get, therefore, a second group of peace conditions, in which the principles are, first, that Germany must be disarmed, so as to be unable to recommence the struggle; secondly, points of commanding strategic importance, such as ports, capital, fortresses, etc., must be occupied; and thirdly, certain solid guarantees, such as the customs and Treasury receipts, railway, and so forth, must be in Allied hands, until the several restorations are completed.

Thirdly, the world must have some security that the agencies which gave rise to this war shall, so far as may be, be extinguished. The military power of Prussia must be ended by the abolition of autocracy and by substituting a constitutionally expressed popular will for that of an irresponsible monarchy.

Reciprocal Obligations.—These three groups deal with the obligations which the Allies will impose on Germany; but there is a fourth group, which must express the obligations which Germany has a right to expect the Allies to honor. The essential matter here is that, as in groups one, two, and three, we shall have prescribed what punitive and retributive justice requires, shall have guaranteed its due execution and prevented the recurrence of the crimes atoned for; so the fourth group shall make it clear not only that there is no effort to impose two punishments for one offence, but no intention of so shaping the punishment as to leave Germany without the power to make the retribution that we exact. If, therefore, we deprive Germany of her present merchant fleet, and require that for six or ten years or more her shipyards shall labor solely to make up the deficit which her present fleet is unable to replace, then it follows that, when the needs of the Allies are reasonably met, a fair service of shipping shall be at Germany's disposal not as possessors, but as users. Again, if by being shorn of her colonies she is deprived of any national source of tropical products, a fair ration of the world's supply must be allowed to her. Further than this, the Allies, and those that sympathize with them, monopolize whole groups of the raw materials of the world. Of these, Germany must have a reasonable proportion. It is obvious that, unless such equitable and, indeed, generous arrangement is made, it will be impossible for Germany to meet the indemnities or to build the shipping, or to make the services effective that she will be under compulsion to put at the Allies' disposal. Our own interests, then, demand a certain largeness of view in dealing with these matters; but there is a higher reason why our conduct in this respect should be exemplary.

A New Spirit in Trade.—The militarism of Germany has not, as we all know, been limited to the action of her armed forces. For many years and in all countries her diplomacy has been secret, double-faced, disloyal, and disruptive. But there is nothing in her military or diplomatic records more rapacious, predatory, and essentially dishonest, than her commercial dealings. These things have excited the reprobation and disgust of the civilized part of the world. It would not be surprising if they were followed by a wide determination to deal with Germany no more. It is, indeed, a very human and a very natural instinct for each individual to say that, whatever others may do, he at least has done with such traffic for ever. But if we are sincerely aiming for a real peace—a settlement that will ultimately result in a reconciliation of wills—we should see that our duty here runs with our interest, and that it is part of our duty to make Germany realize that commercial success and prosperity is not the result of disloyal competition and trickery but of mutual service and cooperation.

Here, then, I might close the general case for the conditions of peace; but the recent exchange of notes between the American and German Governments has brought up other issues, and it is idle to hide from oneself that great uncertainty and anxiety has been excited. It arises in this way.

The Germans, as a preliminary to asking for an armistice, informed President Wilson that they had accepted as a basis of peace the fourteen points of January and the four points of his later speech. In the last note from President Wilson to the Foreign Secretary it was stated that exceptional guarantees were necessary before an armistice could be granted because, the recent constitutional changes notwithstanding, the German Government was still essentially under the domination of the King of Prussia. These two features have given rise to a large number of questions and protest from correspondents. The following are some of them: Are the Allies now tied down to insist on no reparation at the peace, except such as the fourteen points provide? The Germans have bound themselves to the fourteen points, but to no others. Do they limit us just as they bind them? Are we, therefore, debarred from asking for compensation for our lost tonnage? Again, do the fourteen points bind us to adopt the doctrine of the freedom of the seas? Have we abandoned our rights to search and capture? Is the British Navy henceforth powerless unless the League of Nations permits it to act? Is the immediate establishment of a League of Nations with Germany, Austria, and Turkey as members a necessary part of the peace arrangement? Is the ultimate destination of the German colonies to be discussed as if it were a question to be settled either in the German or the British interest alone? And, finally, if Germany adopts a constitution unquestionably democratic must we take this as tantamount to saying that whatever the new Germany undertakes it will carry out, so that a political reform will be held to be equivalent to the military occupation and enforcement of our terms?

Behind these questions there is a misunderstanding both of the position which President Wilson has assumed in the war, and his actual attitude in the recent correspondence. It must, then, be made unmistakably clear that the Chief Magistrate of America speaks for the United States only, for they are not, technically, in alliance with France, Great Britain, Italy, Serbia, and Montenegro, the last survivors of the original combination. They are associated, but not allied with us. The fourteen points were put forward by President Wilson without concert or consultation with the Allied Governments, and represent not the Allies maximum, but the American minimum. They set out in clauses 5 to 13 what seems to an impartial critic of singular acumen, a resettlement of the broad European issues that is at once equitable and necessary. But they do not profess to exhaust what other powers may see to be indispensable both to justice and security. They do not exclude further conditions, further compensations, further indemnities. These the several powers bound by the pact of London must agree amongst themselves and put forward with the authority of all the allies behind them. First, then, let us establish the point that President Wilson has not *professed* to exhaust the Allied case.

Next, in the recent exchange of notes, he has kept perfectly correctly to his technical position. Up to the last of them it is assumed not only that the Allies are not parties to the correspondence, but are even officially ignorant of its existence. What the President proposes to communicate to them is not his observations on the German proposal, but the German proposal itself. The Allies, then, take into cognizance one matter only, viz., that the Germans have applied to President Wilson for an armistice and that the President has forwarded the request. Here again the most punctilious care has been taken not to bind, fetter, or limit either the Allied governments or their naval and military advisers in the smallest degree.

But much more than this, of course, has happened. Two fundamental truths have been brought home to Germany, and have shaken the nation to its foundations. Every German who can read now knows, both by the admissions of his own government and by the masterful tone of Mr. Wilson, that the attempt of the rulers of Germany to conquer has recoiled upon themselves and their subjects. Every German now knows that it is his country, and not those which his rulers have attacked, that is on the eve

of overwhelming defeat. Next, he has learned that the kind of government capable of creating such a war and of carrying it on by the methods that Germany has applauded, is one with which America, at least, will have no civil dealings at all. Militarism, therefore, now appears in its true light to the nation that has so long been its exponent. It is not only an unsuccessful and futile thing: it is a horror which excites such disgust in other peoples that, except at the sword's point, no traffic of any kind can be held with it. This, while the political and military positions have been in every respect most strictly maintained, a moral offensive possibly of a decisive kind has been burst upon the German home front.

"*Freedom of the Seas.*"—We need then have no misgivings as to Mr. Wilson having compromised the Allies, either by his courtesy or by his candor; but the questions which my correspondents have raised deserve discussion, quite apart from this implication. There are three that are vitally important: freedom of the seas, the limitation of indemnities to restoring invaded territories, and the question of the military occupation and constraint of Germany. I have only space to deal here with the first of these questions.

The second of the fourteen points runs as follows: "Absolute freedom of navigation upon the seas outside territorial waters alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants."

It obviously becomes operative only when a League of Nations is established. As it stands, it changes nothing in sea law as it is to-day. It is, in fact, the suggestion of a rule which a League of Nations should adopt when war in defence of national rights will not be the affair of the country whose interests are jeopardized, but of the whole community of nations, who have bound themselves in a mutual obligation to see that justice is done to each. Until, then, we have settled the major point of entrusting the sea defence of the British Empire to a common navy, instead of to the British Navy, we do not have to concern ourselves over any diminution of the British Navy's admitted rights and powers.

But, rightly looked at, clause 2 seems to me to mean exactly the opposite of what it is popularly supposed to import. For the President sets it out that when the league as a league embarks on naval war, it will be able to decree the partial or entire suspension of sea trade with its enemy, thus assuming precisely those maritime rights in war on which the British Navy has all along insisted. Clause 2, in fact, is a vindication of and not a proposed infringement of our broad contentions as to the legitimate use of sea power.

The fourteen points are silent on Germany's economic liability for the disastrous results of her piratical war on shipping. The President's silence on this point is very easily explained. As a simple historical fact, it was the submarine, and nothing else, that brought America into the war. But it was America's moral repudiation of this iniquity, and not her material losses by it, that determined her action. The submarine campaign, instead of diminishing the merchant tonnage of America, has already resulted in measures which have increased it enormously, and these measures will go forward until in a very few years the American merchant marine will be at least double what Germany's was before the war, and more than half of the highest figure that Great Britain has ever attained. The British position is entirely different. Our merchant tonnage has been at the full war service of all the Allies, and for the last 18 months of America. It has afforded the most targets to the submarine; it has paid most highly in consequence. But the service of our sea tonnage has been only part of our naval contribution. We have had to maintain an impregnable fleet; we have had to supply more than 90 per cent of the craft necessary for fighting the submarine. And, quite unexpectedly, our military contribution, instead of being the three or four army corps suggested before hostilities began, had to run to millions almost from the very start. As a

consequence, our shipyards were depleted of their most spirited and efficient labor, and the half-manned yards had to meet the whole demands both of the surface navy and of the new navy called into being to fight the under-water piracy. Never in our history, then, have we been so poorly equipped to make good the losses that we have suffered. It follows, then, that our equitable claim, not only to be whole of the existing German merchant tonnage, but to the service of the German shipyards for a considerable number of years is one that no impartial arbiter could refuse. It is quite certain that President Wilson never intended and that Americans will never require our demands in this matter to be questioned.—*Land and Water*, 31/10.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

JOURNAL OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS. **December.**—Cooling Losses in Internal Combustion Engines as Affecting Design, by *C. A. Norman.*

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS. (Papers read **November 14-16,** to be published in PROCEEDINGS.) Application of Buoyancy Boxes to S. S. *Lucia*, by *W. T. Donnelly*. Experiments Upon Simplified Forms of Ships, by *Prof. H. C. Sadler* and *T. Yamamoto*. Application of Electric Welding to Ship Construction, by *Jasper Cox*.

AERIAL AGE. **November 4.**—Battle Acrobacy or Trick Flying, by *Capt. K. G. Pulliam,* U. S. A.

RUDDER. **December.**—Present and Future of Ship Building, by *Charles Piez.* Potentialities of Our Inland Water Routes, by *Robert G. Skerrett.*

SCIENTIFIC AMERICAN. **December 14.**—Our Navy's Winged Destroyers, by *Austin C. Lescarboura.* The Rise of Navigation, by *R. H. Curtiss.*

JOURNAL OF THE AMERICAN SOCIETY OF NAVAL ENGINEERS. **November.** Mechanical Reduction Gears, by *J. A. Davies.* Ventilating and Heating from the Marine Point of View, by *Chas. F. Gross.* Ox-Acetylene Welding, by *Stuart Plumley.* Screw Propellers, by *Rear Admiral C. W. Dyson, U. S. N.* Dynamic Balancing, by *Commander F. J. Cleary, U. S. N.*

"N. Y. TIMES" CURRENT HISTORY. **December.**—Surrender of German High Seas Fleet. Overseas Transportation of U. S. Troops, by *Commander Charles C. Gill.* Growth of Commissioned Personnel of U. S. Navy, by *Carol Howe Foster.*

FLYING. **December.**—The Navy's Part in the Air (letter from *Vice Admiral Sims*).

GREAT BRITAIN

LAND AND WATER. **November 14.**—The Armistice, by *Hilaire Belloc.* What They Have Missed (Surrender of German Fleet), by *Arthur Pollen.*

ENGINEERING. **November 15.**—Construction and Trials of 30,000-Ton Black Sea Floating Dock.

JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION. **November.**—The Kiao-Chao Campaign, by *Major T. C. Compton.*

DIPLOMATIC NOTES

From November 20 to December 20

PREPARED BY

Allan Westcott, Ph. D., Instructor, U. S. Naval Academy

PRESIDENT WILSON IN PARIS

American Peace Delegates Chosen.—On November 27 it was announced that the American delegation to the peace conference would be as follows:

Woodrow Wilson, who would act as an actual delegate, his place being taken later by Secretary of War Baker.

Robert Lansing, Secretary of State.

Colonel Edward House.

Henry White, formerly Ambassador to France and American delegate at the Algeciras conference in 1906.

David F. Houston, Secretary of Agriculture.

President Justifies His Attendance at Conference.—In his annual message, which he read to Congress on Dec. 2, President Wilson declared that it was his "paramount duty" to attend the peace conference, and requested the encouragement of united support. The part of the message dealing with his departure follows:

Gentlemen of the Congress:

The year that has elapsed since I last stood before you to fulfill my constitutional duty to give to the Congress from time to time information on the state of the Union has been so crowded with great events, great processes and great results that I cannot hope to give you an adequate picture of its transactions or of the far-reaching changes which have been wrought in the life of our nation and of the world. You have yourselves witnessed these things as I have. It is too soon to assess them; and we who stand in the midst of them and are part of them are less qualified than men of another generation will be to say what they mean or even what they have been.

But some great outstanding facts are unmistakable and constitute, in a sense, part of the public business with which it is our duty to deal. To state them is to set the stage for legislative and executive action which must grow out of them and which we have yet to shape and determine.

Troop Shipment Unequaled.—A year ago we had sent 145,918 men overseas. Since then we have sent 1,950,513, an average of 162,542 each month, the number, in fact, rising in May last to 245,951, in June to 278,760, in July to 307,182 and continuing to reach similar figures in August and September—in August 289,570 and in September 257,438.

No such movement of troops ever took place before across 3000 miles of sea, followed by adequate equipment and supplies and carried safely through extraordinary dangers of attack—dangers which were alike strange and infinitely difficult to guard against. In all this movement only

758 men were lost by enemy attack, 630 of whom were upon a single English transport, which was sunk near the Orkney Islands.

I need not tell you what lay back of this great movement of men and material. It is not invidious to say that back of it lay a supporting organization of the industries of the country and of all its productive activities, more complete, more thorough in method and effective in result, more spirited and unanimous in purpose and effort than any other great belligerent has been able to effect. We profited greatly by the experience of the nations which had already been engaged for nearly three years in the exigent and exacting business, their every resource and every executive proficiency taxed to the utmost. We were their pupils. But we learned quickly and acted with a promptness and a readiness that justify our great pride that we were able to serve the world with unparalleled energy and quick accomplishment.

Praises Work of Troops.—But it is not the physical scale and executive efficiency of preparation, supply, equipment and dispatch that I would dwell upon, but the mettle and quality of the officers and men we sent over and of the sailors who kept the seas, and the spirit of the nation that stood behind them. No soldiers or sailors ever proved themselves more quickly ready for the test of battle or acquitted themselves with more splendid courage and achievement when put to the test.

Those of us who played some part in directing the great processes by which the war was pushed irresistibly forward to the final triumph may now forget all that and delight our thoughts with the story of what our men did. Their officers understood the grim and exacting task they had undertaken and performed it with an audacity, efficiency and unhesitating courage that touch the story of convoy and battle with imperishable distinction at every turn, whether the enterprise were great or small—from their great chiefs, Pershing and Sims, down to the youngest lieutenant; and their men were worthy of them—such men as hardly need to be commanded, and go to their terrible adventure blithely and with the quick intelligence of those who know just what it is they would accomplish. I am proud to be the fellow countryman of men of such stuff and valor.

Duty Also Well Done by Those at Home.—Those of us who stayed at home did our duty; the war could not have been won or the gallant men who fought it given their opportunity to win it otherwise; but for many a long day we shall think ourselves "accurs'd we were not there and hold our manhoods cheap while any speaks that fought," with those at St. Mihiel or Thierry. The memory of those days of triumphant battle will go with these fortunate men to their graves, and each will have his favorite memory.

Old men forget, yet all shall be forgot, but he'll remember with advantages what feats he did that day!

What we all thank God for with deepest gratitude is that our men went in force into the line of battle just at the critical moment when the whole fate of the world seemed to hang in the balance and threw their fresh strength into the ranks of freedom in time to turn the whole tide and sweep of the fateful struggle—turn it once for all, so that thenceforth it was back, back, back, for their enemies; always back, never again forward! After that it was only a scant four months before the commanders of the Central Powers knew themselves beaten, and now their very empires are in liquidation! [Part of message omitted.]

His "Paramount Duty" to Go.—I welcome this occasion to announce to the Congress my purpose to join in Paris the representatives of the governments with which we have been associated in the war against the Central Empires for the purpose of discussing with them the main features of the treaty of peace. I realize the great inconveniences that will attend my leaving the country, particularly at this time, but the conclusion that it was my paramount duty to go has been forced upon me by con-

siderations which I hope will seem as conclusive to you as they have seemed to me.

The allied governments have accepted the bases of peace which I outlined to the Congress on the 8th of January last, as the Central Empires also have, and very reasonably desire my personal counsel in their interpretation and application, and it is highly desirable that I should give it in order that the sincere desire of our government to contribute without selfish purpose of any kind to settlements that will be of common benefit to all the nations concerned may be made fully manifest.

The peace settlements which are now to be agreed upon are of transcendent importance both to us and to the rest of the world, and I know of no business or interest which should take precedence of them.

The gallant men of our armed forces on land and sea have consciously fought for the ideals which they knew to be the ideals of their country; I have sought to express those ideals; they have accepted my statements of them as the substance of their own thought and purpose, as the associated governments have accepted them; I owe it to them to see to it, as far as in me lies, that no false or mistaken interpretation is put upon them, and no possible effort omitted to realize them. It is now my duty to play my full part in making good what they offered their life's blood to obtain. I can think of no call to service which could transcend this.

I shall be in close touch with you and with affairs on this side the water, and you will know all that I do. At my request the French and English governments have absolutely removed the censorship of cable news which until within a fortnight they had maintained, and there is now no censorship whatever exercised at this end except upon attempted trade communications with enemy countries.

It has been necessary to keep an open wire constantly available between France and the Department of War. In order that this might be done with the least possible interference with the other use of the cables, I have temporarily taken over the control of both cables in order that they may be used as a single system.

I did so at the advice of the most experienced cable officials, and I hope that the results will justify my hope that the news of the next few months may pass with the utmost freedom and with the least possible delay from each side of the sea to the other.

May I not hope, gentlemen of the Congress, that in the delicate tasks I shall have to perform on the other side of the sea, in my efforts truly and faithfully to interpret the principles and purposes of the country we love, I may have the encouragement and the added strength of your united support? I realize the magnitude and difficulty of the duty I am undertaking; I am poignantly aware of its grave responsibilities.

I am the servant of the nation. I can have no private thought or purpose of my own in performing such an errand. I go to give the best that is in me to the common settlements which I must now assist in arriving at in conference with the other working heads of the associated governments. I shall count upon your friendly countenance and encouragement.

I shall not be inaccessible. The cables and the wireless will render me available for any counsel or service you may desire of me, and I shall be happy in the thought that I am constantly in touch with the weighty matters of domestic policy with which we shall have to deal.

I shall make my absence as brief as possible, and shall hope to return with the happy assurance that it has been possible to translate into action the great ideals for which America has striven.

PRESIDENT SUPPORTS FULL NAVAL PROGRAM.—In the same message the President endorsed as follows the current naval estimates:

I take it for granted that the Congress will carry out the naval program which was undertaken before we entered the war. The Secretary of the

Navy has submitted to your committees for authorization that part of the program which covers the building plans for the next three years.

These plans have been prepared along the lines and in accordance with the policy which the Congress established, not under the exceptional conditions of the war, but with the intention of adhering to a definite method of development for the navy. I earnestly recommend the uninterrupted pursuit of that policy. It would clearly be unwise for us to attempt to adjust our programs to a future world policy as yet undetermined.

The question which causes me the greatest concern is the question of the policy to be adopted towards the railroads. I frankly turn to you for counsel upon it. I have no confident judgment of my own. I do not see how any thoughtful man can have who knows anything of the complexity of the problem. It is a problem which must be studied, studied immediately and studied without bias or prejudice. Nothing can be gained by becoming partisans of any particular plan of settlement.

THE PRESIDENT'S VOYAGE.—President Wilson and his party sailed from New York on the U. S. S. *George Washington* on Thursday, December 5, and, arriving in Brest on Friday, reached Paris Saturday morning, December 14. He was given an enthusiastic reception by the people of Paris, and on the same day responded to the welcome of President Poincaré and to an address presented by a Socialist delegation. The reply to President Poincaré follows:

"Mr. President: I am deeply indebted to you for your gracious greeting. It is very delightful to find myself in France and to feel the quick contact of sympathy and unaffected friendship between the representatives of the United States and the representatives of France.

"You have been very generous in what you were pleased to say about myself, but I feel that what I have said and what I have tried to do has been said and done only in an attempt to speak the thought of the people of the United States truly, and to carry that thought out in action.

"From the first, the thought of the people of the United States turned toward something more than the mere winning of this war. It turned to the establishment of eternal principles of right and justice. It realized that merely to win the war was not enough; that it must be won in such a way and the question raised by it settled in such a way as to insure the future peace of the world and lay the foundations for the freedom and happiness of its many peoples and nations.

"Never before has war worn so terrible a visage or exhibited more grossly the debasing influence of illicit ambitions. I am sure that I shall look upon the ruin wrought by the armies of the Central Empires with the same repulsion and deep indignation that they stir in the hearts of the men of France and Belgium, and I appreciate, as you do, sir, the necessity of such action in the final settlement of the issues of the war as will not only rebuke such acts of terror and spoliation, but make men everywhere aware that they cannot be ventured upon without the certainty of just punishment.

"I know with what ardor and enthusiasm the soldiers and sailors of the United States have given the best that was in them to this war of redemption. They have expressed the true spirit of America. They believe their ideals to be acceptable to free peoples everywhere, and are rejoiced to have played the part they have played in giving reality to those ideals in cooperation with the armies of the Allies. We are proud of the part they have played, and we are happy that they should have been associated with such comrades in a common cause

"It is with peculiar feeling, Mr. President, that I find myself in France joining with you in rejoicing over the victory that has been won. The ties that bind France and the United States are peculiarly close. I do not know in what other comradeship we could have fought with more

zest or enthusiasm. It will daily be a matter of pleasure with me to be brought into consultation with the statesmen of France and her allies in concerting the measures by which we may secure permanence for these happy relations of friendship and co-operation, and secure for the world at large such safety and freedom in its life as can be secured only by the constant association and co-operation of friends.

"I greet you not only with deep personal respect, but as the representative of the great people of France, and beg to bring you the greetings of another great people to whom the fortunes of France are of profound and lasting interest.

"I raise my glass to the health of the President of the French Republic and to Mme. Poincaré and the prosperity of France."

INTERALLIED CONFERENCES POSTPONED.—Plans for the reassembling of the Interallied Conference and the meetings of the Peace Congress are gradually being matured. It was the first intention to have the Interallied Conference meet to-morrow or Tuesday, but owing to the inability of Premier Lloyd George and Foreign Minister Balfour to be here because of the British elections and the approaching holidays, the formal session will not be resumed until after Jan. 1.

Meanwhile President Wilson will have an opportunity to confer with the Premiers and leading statesmen of the Allies and to visit the battlefields and perhaps Italy. King Victor Emmanuel, the Crown Prince and Premier Orlando arrived in Paris Thursday. They will dine with the President some time this week.

The merits of the questions and considerations to come before the conference thus far have developed only in their initial phases, discussions of them having been more or less informal. For the American delegates the chief object to be obtained during the next fortnight is a first-hand understanding of the views of the European statesmen and an opportunity to convey to them the American point of view.—*N. Y. Times*, 16/12.

FREEDOM OF THE SEAS

In press and public discussion during the period preceding the opening of the formal peace conference, the President's statement regarding freedom of the seas took precedence over other issues, as the clause most difficult of interpretation and most likely to involve differences of opinion among the allied powers. It will be recalled that clause 2 of the President's "Fourteen Points" of January 8, 1918, read as follows:

2. Absolute freedom of navigation upon the seas, outside territorial waters, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.

The allied governments, in agreeing to the German request for an armistice, accepted the President's terms of peace, but made an exception of this clause, pointing out that the phrase *freedom of the seas* was "open to various interpretations, some of which they could not accept." They therefore "reserve to themselves complete freedom on this subject when they enter the peace conference." In later discussion it was generally agreed that in time of peace "freedom of the seas" had already existed throughout the past century. It was further accepted that, should some form of a league of nations come into being, the power of blockade and interdiction of commerce would be employed by it as a most effective measure against nations violating the agreements of the league. If, however, such a league were not formed, doubt was expressed whether the maritime states would be wise to give up the safeguards of commerce warfare, which in the past had been the chief weapon of sea power. Following are quotations from various sources.

CHURCHILL SAYS BRITAIN WON'T LIMIT NAVY.—In a speech at Dundee on Dec. 5, Winston Churchill declared that British delegates at the peace conference would demand abolition of conscription throughout Europe, but that Great Britain would consent to no limitation of her naval defence. These views were afterward expanded as follows in an article in the Glasgow *Sunday Post:*

"Our safety from invasion, our daily bread, every means whereby we maintain our existence as an independent people; our unity as an empire or federation of commonwealths and dependencies—all these float from hour to hour upon our naval defence," Mr. Churchill writes.

"If that defence is neglected, weakened, or fettered," he continues, "we all shall be in continual danger of subjugation or starvation. We should be forced to live in continued anxiety. If that naval defence were overpowered or outmatched by any other navy, or probably by a combination of navies, we should hold, not merely our possessions, but our lives and liberties, only on sufferance.

"Where else in the whole world can such conditions be paralleled? We have the right to demand from all other nations, friends and foes alike, full recognition of those facts. We are also entitled to point out that this naval strength that we require and which we are determined to preserve has never been used in modern history in a selfish and aggressive manner, and that it has on four separate occasions in four separate centuries—against Philip II of Spain, Louis XIV, Napoleon, and the Kaiser—successfully defended civilization from military tyranny, and particularly preserved the independence of the Low Countries.

"In this greatest of all wars the British Navy shielded mighty America from all menace of serious danger, and when she resolved to act it was the British Navy that transported and escorted the greater proportion of her armies to the rescue and deliverance of France. Our record in a hundred years of unquestioned naval sway since Trafalgar proves the sobriety of our policy and the righteousness of our intentions. Almost the only ports in the world open freely to the commerce of all nations were those of our islands. Its possessions and our coaling stations were used freely and fully by the ships of all nations.

"We suppressed the slave trade. We put down piracy. We put it down again the other day. Even our coastwise traffic, so jealously guarded by every power in the world, was thrown open to all comers on even terms by that ancient people in whose keeping the world has been wisely ready to intrust the freedom of the seas.

"We are sincere advocates of a League of Nations. Every influence Britain can bring to bear will be used to make such a league a powerful reality. This fine conception of President Wilson has been warmly welcomed by British democracies all over the world. We shall strive to faithfully and loyally carry it into being and keep it in active benefit and existence. But we must state quite frankly that a League of Nations cannot be for us a substitute for the British Navy in any period that we can foresee."

BRITISH PRESS ON FREEDOM OF SEAS.—The London *Times* reports Mr. Macpherson, the Under-Secretary for War, as saying:

"We are an island. Our one security is our navy. We can never submit to anything that can weaken this one security."

Archibald Hurd, the naval critic of the London *Daily Telegraph,* thinks that freedom of the seas is another way of saying "abolish the right of blockade," and he argues that—

"In war, as recent events have shown, effective freedom of the seas, as of the world, demands maintenance of ancient sea rights which have repeatedly proved to be the salvation of civilization. Philip II of Spain,

Napoleon, and the Kaiser were defeated, and the American Union was saved thereby in the Civil War. Abolition of the blockade and of contraband would reduce the value of sea-power 75 per cent, because it would enable great continental armies to be sustained almost indefinitely. The sea controls the land, and so-called freedom of the seas means military autocracy by land."

Another prominent naval expert, Mr. A. H. Pollen, of the London *Pall Mall Gazette*, agrees, and remarks:

"Germany was defeated largely because, at last, she was effectively besieged by sea. Had neutrals been free to supply her, the war might have continued another year. Had all supplies, especially from America, been stopped from the first, it would have been over long ago. Non-combatant trading with Germany has cost Europe and America millions of lives and fifty billion dollars. If this is freedom of the seas, it has been a costly luxury."

The Manchester *Guardian* is the only English paper that professes to know the President's mind on this subject, and it tells us:

"By freedom of the seas he did not mean that naval fortresses such as Gibraltar or fleets should be interfered with, but that in peace or war there should be freedom of neutral navigation except when action was taken by the League of Nations. Submarine action, it was argued, had changed the whole question of blockade, and the two island kingdoms had more to gain by this freedom of the seas than countries with land borders."

In the course of an exhaustive article the London *Spectator* makes this flat statement:

"When the time arrives for presenting to Germany the final terms of peace for her acceptance or rejection, it will be of the utmost importance that all the associated powers should speak with one voice. To this end it is essential that each power should frankly state its own point of view wherever that, either in substance or in fact, differs from views expressed by other members of the great partnership. In the affairs of nations, as of individuals, frankness combined with courtesy is an essential element of good fellowship. For this reason it is most desirable that the newspaper press and the public men of Great Britain should make clear without delay that in no circumstances can an island power, which is also the center of a sea-linked empire, consent to what is called 'the freedom of the seas' if that term carries the meaning which has usually been attached to it in this country."

The reason for this definite rejection is then given:

"Let us see, then, what would be the consequences of the 'freedom of the seas,' that we have always repudiated. President Wilson demands 'absolute freedom of navigation upon the seas outside territorial waters alike in peace and in war.' Now, in peace there already is absolute freedom of navigation. Therefore what President Wilson must mean is 'in war as well as in peace.' That is the real issue. The President of the United States apparently proposes that when two nations are at war they shall only fight on land, or within their own territorial waters. No reason is advanced for this limitation of the area of warfare. War at sea is in no respect more cruel than war on land: in some respects it is less cruel.

"The idea underlying this proposal is that the seas outside territorial waters are the common possession of the whole world, and what is common to all should not be used as a battle-field by some. That is certainly an attractive idea, but will it bear examination? The sea is not merely a vacant space: it is also a highway. The effect of President Wilson's proposal, strictly interpreted, would be that a belligerent could use the sea as a safe highway for his troops up to the three-mile line, which is the boundary of territorial waters. The Germans, for example, would be at liberty to organize a gigantic fleet of transports loaded with men and munitions, and these transports might move up

and down the coasts of England and Scotland seeking a safe landing-place, and as long as they kept outside the three-mile limit they would be immune from attack."

Most of the comment in the Paris papers emphasizes the fact that President Wilson has not yet defined what he means by freedom of the seas, but most of the French journals agree with the *Matin* when it says: "If this doctrine means any diminution of the power of the British Navy, France will reject it."

Both the *Temps* and the *Journal des Débats* point out how anxious Germany would be to disarm the western nations, especially England, on the sea, if she could only do so.—*Literary Digest,* 14/12.

BRITISH NAVAL POLICY JUSTIFIED.—The supremacy of her fleet is the "Monroe Doctrine" of the British Empire; indeed the maintenance of this supremacy is even more vital to her security than is the maintenance of the Monroe Doctrine to the security of the United States. A violation of the Monroe Doctrine would not necessarily imperil our existence as a nation; whereas it is well understood that a defeat of the British fleet would sound the death-knell of the whole British Empire.

Unlike the United States, which is entirely self-supporting and geographically a unit, the British Empire consists of an island, no larger than some of our smaller states, which is the seat of the Imperial Government and the heat of the system, with numerous outlying colonies and dominions scattered throughout the world. If the mother country be considered as the heart of the system, the trade routes of the world are its arteries.

Only so long as these arteries are unobstructed can the empire function. If Great Britain were blockaded and the trade routes of the world were controlled by an enemy, the mother country would be starved into submission in a few months' time, and the whole empire would fall like a house of cards. Hence she has laid it down that her fleet must always be of sufficient strength to preserve intact the great trade routes of the high seas. To insure this, she has made it her policy to maintain a navy equal in strength to that of any other two navies combined.

This policy is purely protective and has been accepted as such by every naval power except the one which recently aimed at the domination of the world. And in pursuance of her policy of preserving the freedom of the seas, she has followed a liberal course. Her ports have been open to the ships of all the world upon equal terms with those of her own merchant marine. She has charted the seven seas; and these charts, representing an outlay of millions of dollars, have been at the service of the whole mercantile world. Her markets have been open, without any restrictions, to the goods of her competitors in trade, including those of her greatest rival, Germany. She charges the same harbor dues and the pilot dues are the same.

In guarding the trade routes to her far-flung empire, she has, incidentally, preserved the freedom of the seas for the whole maritime world. Her record is clean and consistent; for tree trade and free seas have been the indispensable corollary, the one of the other.—*Scientific American,* 14/12.

MR. ROOSEVELT ON ANGLO-AMERICAN PEACE.—In a letter, dated Dec. 5, to Col. George Haven Putnam, Mr. Roosevelt said in part:

I regard the British Navy as probably the most potent instrumentality for peace in the world. I do not believe we should try to build a navy in rivalry to it, but I do believe we should have the second navy in the world. Moreover, I am now prepared to say what five years ago I would not have said. I think the time has come when the United States and the British Empire can agree to a universal arbitration treaty. In other words, I believe that the time has come when we should say that under no circumstances shall there ever be a resort to war between the United States and

the British Empire, and that no question can ever arise between them that cannot be settled in judicial fashion, in some such manner as questions between states of our own Union would be settled.

It is wicked not to try to live up to high ideals and to better the condition of the world. It is folly, and maybe worse than folly, not to recognize the actual facts of existence while striving thus to realize our ideals. There are many countries not yet at a level of advancement which permits real reciprocity of relations with them, and many other countries so completely unlike our own that at present no such agreement would be possible with them. But the slow march forward of the generations has brought the English speaking peoples to a point where such an agreement is entirely feasible; and it is eminently desirable among ourselves.

A LEAGUE OF NATIONS

MR. BALFOUR DECLARES LEAGUE ESSENTIAL.—In an interview to press representatives on Dec. 6, Foreign Secretary Balfour expressed himself as follows in favor of an international league:

The Foreign Secretary said he believed the question of a League of Nations was the most important work imposed on the conference.

"The prominence Mr. Wilson has given the subject is a valuable contribution to civilization," he declared. "I think a league of nations a vital necessity if this war is to produce all the good we expect to come out of it. The United States would have to bear a large share in the work it involves. It should be something more than a mere instrument to prevent war. The world is more complicated than we are inclined to think. It would be folly to imagine it possible to constitute a world with states endowed with equal powers and rights.

"But I wish to say emphatically that in my opinion to devise in concert workable machinery for them is one of the highest functions the conference can deal with."

Referring to President Wilson's phrase, "make the world safe for democracy," Mr. Balfour said:

"I do not think the world can be made safe for democracy merely by multiplying the number of democratic states. . . .

"I believe a league of nations will be required to superintend and control not only the criminal ambitions of great autocracies, but to prevent any rash and inconsiderable countries from going to war. It is impossible to talk about democracy except for countries which have reached a relatively advanced stage of civilization. A league could be trustee for those less developed. Holding this view, I regard a league of nations the greatest work of the conference."—*N. Y. Times*, 7/12.

SIR ROBERT CECIL ADVOCATES LEAGUE.—Addressing a body of American editors on Dec. 2, Lord Robert Cecil said:

We talk lightly of a league of nations, some of us, and I am not sure that all those who talk about it have really considered what it means. We have to reconcile two principles, both entitled to our warmest support—national sovereignty and international cooperation. Believe me, only those who have tried in detail to reconcile those principles know the difficulties that there are. But that we ought to try, that we ought to set up some system of that kind, that we ought to establish it as a guarantee for our descendants against the evils we have been through, no one who is neither a lunatic nor an imbecile can doubt. We have to do something, and let us approach the task in the right spirit. Let us cast aside as far as we can selfish aims, selfish ambitions, and selfish aspirations, and approach this task in that spirit and with those desires, and I doubt not we may bring it to a successful conclusion.—*N. Y. Nation*, 14/12.

GREAT BRITAIN

PARLIAMENTARY ELECTIONS.—General elections were held in the United Kingdom on Dec. 14, for the first time under the wider suffrage. Little apparent interest was taken in the political campaign. The election gave an increased parliamentary majority for the present government.

LLOYD GEORGE ON ALLIES' WAR BILL.—Bristol, England, December 11 (Associated Press).—The war bill of the Allies against Germany is £24,000,000,000 ($120,000,000,000), according to the British Prime Minister, David Lloyd George, who spoke before a large gathering here to-day.

Before the war the estimated wealth of Germany, said the Premier, was £15,000,000,000 to £20,000,000,000 sterling, so that if the whole wealth of Germany were taken, he said, there would not be enough to pay the account, therefore, he had before this used the words, "Germany should pay to the utmost limit of her capacity."

The Premier stated that the war had cost Germany less than it had cost Great Britain. It had cost Great Britain, he stated, £8,000,000,000 ($40,000,000,000)—a gigantic sum. The German bill, he believed, was £6,000,000,000 ($30,000,000,000) or £7,000,000,000, ($35,000,000,000). He contended that it was indefensible that the person who was in the wrong and had lost should pay less than the person who was declared to be in the right and had won.

Demands Full Cost of War.—The Premier said that a British Imperial Commission had been appointed to investigate the capacity of Germany (to pay) and that he had received its report. He summarized his remarks on this point as follows:

First—As far as justice is concerned we have an absolute right to demand the whole cost of the war from Germany.

Second—We propose to demand the whole cost of the war from Germany.

Third—When you come to the exacting of it, we must exact in such a way that it does not do more harm to the country that receives it than the country that is paying for it.

Fourth—The committee appointed by the British Cabinet believes that that can be done.

Fifth—The Allies are in exactly the same boat. We shall put in our demands all together and whatever they are they must come in front of the German war debt.

The Prime Minister continued:

"The first consideration in the minds of the Allies will be the interests of the people upon whom the Germans have made war, and not in the interests of the German people who have made war and have been guilty of that crime."

Total Claims.—The bill of $120,000,000,000, which Premier Lloyd George said at Bristol yesterday the Allies had against Germany, is evidently based upon the accounts which the various allies have against the Berlin Government, and which approximates their actual expenditures for the war, plus damages in certain cases.

According to returns calculated by the Metals National Bank of New York, these expenditures amount to $123,400,000,000, distributed as follows:

Great Britain	$41,500,000,000
United States	18,000,000,000
France	26,800,000,000
Russia	21,500,000,000
Italy	8,500,000,000
Belgium, etc.	7,100,000,000
Total	$123,400,000,000

—*N. Y. Times*, 12/12.

BELGIUM

BELGIAN GOVERNMENT REESTABLISHED IN BRUSSELS.—On Nov. 22, King Albert again addressed the Belgian Parliament in the redeemed capital city. In his speech he promised universal and equal suffrage and equal rights to both Flemings and Waloons. Belgium, he declared, would no longer trust to a guaranteed neutrality but would "rule its destinies according to its aspirations and in full sovereignty."

At the time of King Albert's re-entry into Brussels President Wilson sent this congratulatory telegram:

"At the moment that you re-enter Brussels at the head of your victorious army, may I not express the great joy that it gives to me and to the American people to hail your return to your capital, marking your final triumph in this way, which has cost your nation so much suffering, but from which it will arise in new strength to a higher destiny?"

The new Belgian ministry consists of six Catholics, three Liberals, and three Socialists, with M. Hymans as Minister of Foreign Affairs.

GERMANY

CROWN PRINCE RENOUNCES CLAIM TO THRONE.—Crown Prince Frederick William has renounced his right to the German throne. A dispatch received in Basle from the semi-official Wolff Bureau in Berlin quotes the renunciation as follows:

I renounce formally and definitely all rights to the Crown of Prussia and the Imperial Crown, which would have fallen to me by the renunciation of the Emperor-King, or for other reasons.

Given by my authority and signed by my hand; done at Wieringen, Dec. 1, 1918. WILHELM.

EX-KAISER ASKED TO LEAVE HOLLAND.—Holland is just awakening to the danger of harboring the Hohenzollerns.

The question of the ex-Kaiser was again brought up in the Second Chamber yesterday, and after he has been here one month it is decided that he is an unwelcome guest and that the Government would have preferred for him not to come to Dutch territory. The Premier's statement that Wilhelm abdicated Nov. 9, but that the Dutch Minister only communicated the facts Nov. 27, is considered worthy of further investigations.

The *New York Times* correspondent learns from official Dutch circles that the ex-Kaiser is to be unofficially but definitely informed within the next few days, if not to-day, that he is *persona non grata* to Holland, and that, moreover, he is a menace to the state. This coincides with the statements in the Second Chamber. If he refuses to take the hint, it is likely that official steps will be taken.

On asking where the ex-Kaiser would be sent *The Times* correspondent received the answer:

"That is not Holland's business, but he can only go to Germany."—*N. Y. Times*, 14/12.

THE HAGUE, DECEMBER 16.—The Amsterdam *Telegraaf* reports this morning that the ex-Kaiser has been requested to leave the country voluntarily, owing to the precarious position of Holland if her hospitality to him continues. According to the *Telegraaf*, the ex-monarch refuses to heed the request.

ARMISTICE APPEALS MUST GO TO ALL ALLIES.—The State Department has given formal notice to Germany and Austria, through the legations in charge of the interests of those Governments here, that the United States

insists that communications addressed to the United States Government or to the President of the United States as to the terms of armistice or as to other matters in which the associated governments are alike concerned should be sent to all the associated governments and not to this government alone.

This is the second request along this line which the State Department has made to the enemy countries. The latest note, which Acting Secretary Polk has sent to the Swiss and Swedish legations for transmission to Germany and Austria, is brought out particularly by a communication from the National Council of Lemburg, regarding boundary lines, and brought out also by various other communications received from Austria and Germany which bore no evidence of having been similarly communicated to the governments associated with the United States.—*Official Bulletin*, 10/12.

SOLF QUITS FOREIGN OFFICE.—At the end of November the Executive Committee of the Workers' and Soldiers' Council in Germany demanded that the People's Commissioners dismiss Foreign Secretary W. S. Solf, who had held over from the old régime. This demand on the part of the radical faction was first pushed by Kurt Eisner, Premier of Bavaria, who threatened the separation of Bavaria, unless the central government rid itself of men regarded as not in full sympathy with the extreme Socialist wing.

Though this policy of the radicals received slight support, it was announced on Dec. 11 that Dr. Solf had handed in his resignation, which had been accepted by the Ebert-Haase Cabinet.

EBERT CABINET GAINS STRENGTH.—Following its establishment, the Ebert government in Germany steadily strengthened its control. On Nov. 24 the Liebknecht faction attempted in vain to force itself into power. On the night of Dec. 6 apparently prearranged rioting and disorder occurred in Berlin, which, however, instigated, demonstrated that the established government was receiving general support. On this occasion the Executive Committee of the Soldiers' and Workers' Council was arrested, apparently without authorization, by a body of soldiers. They were at once released by order of the government.

A crowd of about 500, formed to secure the release of the arrested committee, was in the meantime fired upon by guards, with the result that 12 or 15 were killed and some 50 wounded. While this was going on, a long column of soldiers and sailors marched down the Wilhelm strasse to the Chancellor's Building and their leader in a speech condemned the Soldiers' and Workmen's Council and attempted to proclaim Ebert President of the German Republic. Ebert declined in the following words:

"Comrades and friends, I am unwilling to accept your offer without first having consulted my colleagues in the government. This is so serious a matter that it must be left to the Council of the People's Commissioners."

MEETING OF SOVIET COUNCIL, DECEMBER 16.—In the palace of the Prussian Diet in Berlin, the National Conference of Soldiers' and Workers' Councils assembled, some 450 in number, on Dec. 16. More than half of them were ex-soldiers still in field gray, with a few ex-officers, and the remainder chiefly of the "hard working, deep thinking type of factory

employee." One of the first acts of the Conference was to defeat decisively a resolution introduced by the Spartacus group proposing that Karl Liebknecht and Rosa Luxemburg be invited to attend the gathering.

The People's Commissioners, Ebert, Barth, Haase, Rittmann, Landsberg, and Schiedemann, together with the Executive Committee of the Council, occupied the benches reserved for the government under the old régime. Richard Müller, one of the two presidents of the Executive Committee of the Soldiers' and Workers' Council, opened the meeting. He was followed by Commissioner Ebert, who dwelt in his speech on the future of the socialist republic and insisted on the necessity of establishing a stable government.

The sentiment of the meeting indicated that the National Assembly, originally scheduled for Feb. 16, would be held early in January.

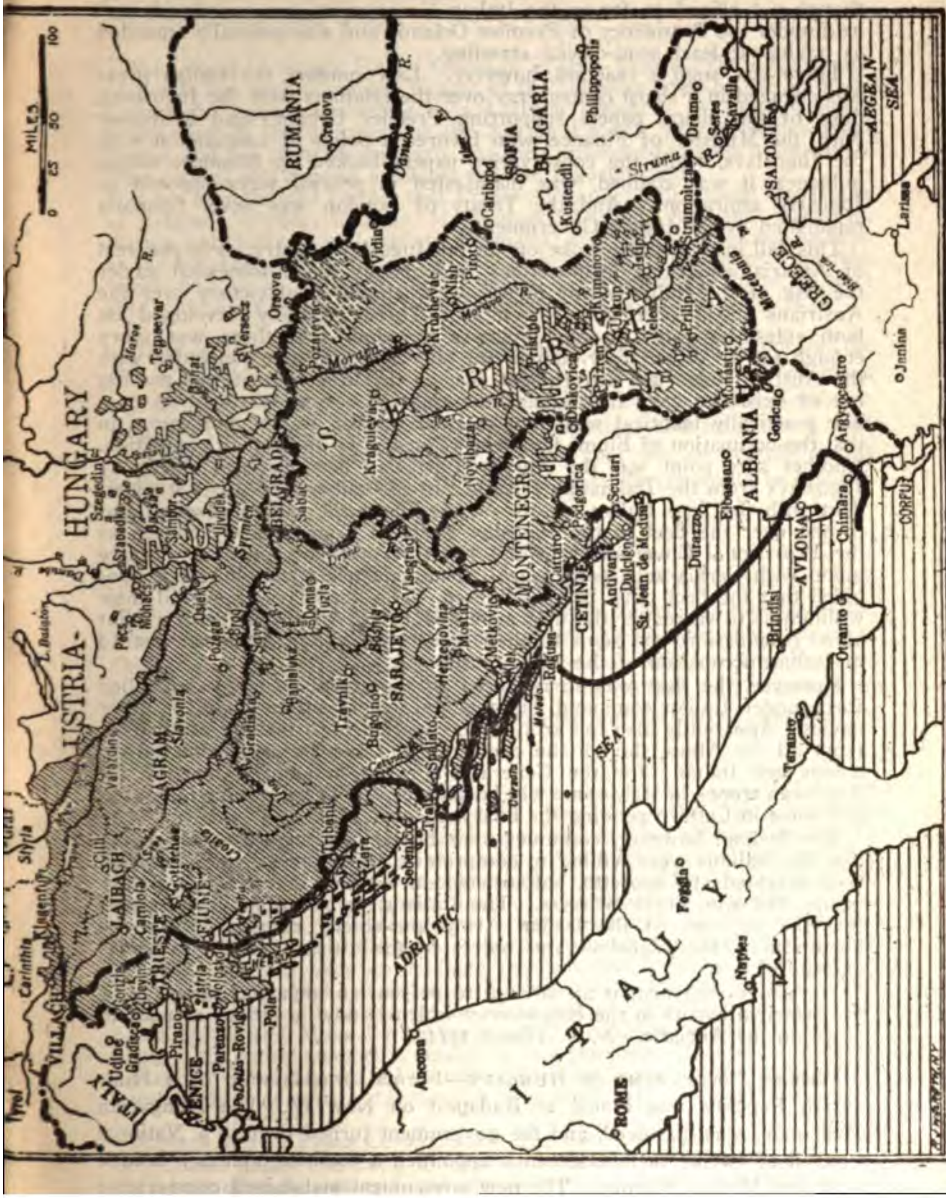
SOUTHEASTERN EUROPE

THE ADRIATIC PROBLEM.—One of the most serious danger points in European international relations at present is the conflict between Italians and Jugoslavs regarding the proper boundary between the two nations east of the Adriatic.

The Treaty of London in April, 1915, on the basis of which Italy entered the war, allotted to Italy, if she could get it, the annexation of Austrian territory east of the Adriatic, including all of Gorizia-Gradisca and Istria, with the City of Trieste, together with the coastal province of Dalmatia as far as a line just north of Spalato, and most of the Dalmatian Islands. (See map.) In this region there were several hundred thousand Italians and nearly a million Jugoslavs—Slovenes and Croats in Istria and Gorizia-Gradisca, Serbo-Croats in Dalmatia. Each side claims that the Austrian census figures are falsified in favor of the other, and there is dispute as to geographical distribution of the races. Generally, however, it may be said that the Italian population predominates in the western part of Gorizia-Gradisca and Istria, and in several of the chief seaports. The population of the back country and of the islands is almost wholly Slav.

Knowledge of the Italian aspirations excited many Jugoslav troops in the Austro-Hungarian Army to fight willingly against the Italians; but many thousands of them, placed against the Russians or Serbs, surrendered without fighting and were presently formed into Jugoslav legions which fought hard in the allied armies. The fact that the Serbian people were to be included in the proposed unified State of Jugoslavia, and that they were deeply interested in the welfare of all parts of the race, made the question very largely one between two allies. A large section of the liberal Italian press, most notably the Corriere della Sera of Milan, protested against the annexation program whose most active official supporter was the Foreign Minister, Baron Sydney Sonnino; and when Trotzky published the text of the London treaty last winter further protests followed.

This favored the movement toward cooperation between the two nations, which would divide the coast of the Adriatic between them in the event of the defeat of Austria-Hungary; it was argued by many of their leaders that they were natural allies, threatened by the common Austro-Hungarian danger. So, after the Italian defeat at Caporetto an agreement was signed between Dr. Ante Trumbitch, President of the Jugoslav Committee, and Andrea della Torre, a well-known Italian journalist representing the elements friendly to the Jugoslavs, which suggested as a solution that territorial questions should be settled on the basis of self-determination, "with due regard to the vital interests of the two peoples," and that full



SHADED AREA REPRESENTS EXTREME JUGOSLAV CLAIMS; BLACK LINE IS LIMIT OF ITALIAN CLAIMS

rights should be granted by each race to minorities of the other that might be included within its borders. This agreement was reaffirmed at the Congress of Oppressed Nationalities held at Rome last April, which, though not official so far as the Italian Government was concerned, was held under the Presidency of Premier Orlando and was generally regarded as having at least semi-official standing.

There was soon a reaction, however. Last summer the Italian press was engaged in a sharp controversy over the relations with the Jugoslavs, most of the liberal papers supporting Premier Orlando and Professor Nitti, the Minister of Finance, who favored a policy of conciliation with the Jugoslavs, while the conservative papers backed up Sonnino, whose influence, it was claimed, was manifested in several ways opposed to Jugoslav aspirations. And the Treaty of London was never formally repudiated by the Italian Government.

This fall insurrections broke out in the Jugoslav country, as in the rest of Austria, and these insurrections undoubtedly made somewhat easier the task of the Italian Army in its overwhelming final victory over the Austrians in October and November. There promptly developed on both sides, however, an unwillingness to admit that there was glory enough for all or territory enough for all. The armistice concluded with the Austro-Hungarian Government just as that government was passing out of existence gave the Italians the right to occupy territory up to a line practically identical with that marked off for Italian annexation in that the occupation of Fiume had been requested by the Italian population. Another sore point was the Austro-Hungarian fleet, manned chiefly by Jugoslavs from the Dalmatian Islands. In the collapse of Austria coincident with the final Italian victory on the Piave the sailors revolted and turned over the fleet to the Jugoslav National Council newly chosen as the Provisional Government of the Jugoslav provinces pending ultimate union with Serbia and Montenegro. The armistice terms, however, provided that the fleet must be surrendered. The Jugoslavs expressed their willingness to surrender the fleet provisionally to Americans or to a joint allied commission, and some of their leaders asked for American instead of Italian occupation of the allied territory.

However, the fleet was surrendered without trouble, and to an allied force under Italian command, but including representatives of the other navies. Apparently also the army of occupation is to include contingents from all the Allies, though the command and the major portion of the troops are Italian; for the General Staff has announced that of the American troops in Italy some will be stationed in Trieste, some in Fiume, and some in Cattaro pending the final settlement.

The feeling, however, continues very bitter, the Jugoslavs contending that the Italians were willing to compromise when their armies had just been defeated at Caporetto, but insisted on extreme demands after their troops had won great victories. The Italians, on the other hand, assert that the victories of the Italian Army are chiefly responsible for the liberation of the Jugoslavs and object to the attitude of the latter as ungrateful.

The above statement is an attempt to present an impartial summary of the principal events in the controversy which is now a serious menace to peace on the Adriatic.—*N. Y. Times*, 15/12.

PRESENT GOVERNMENT OF HUNGARY.—Formal proclamation of a Hungarian Republic was issued at Budapest on Nov. 17. The Hungarian Parliament was dissolved, and the government turned over to a National Council of twenty members, which appointed a coalition ministry headed by Count Michael Karolyi. The new government maintained comparative order, though faced by famine, and though its power extended little

beyond the city of Budapest. The Jugoslavs, Rumanians, Ruthenians, and Chechoslovaks, formerly under Magyar domination, now lay claim to practically all the old Hungarian territory, their claims in many cases conflicting with each other.

ALEXANDER OF SERBIA HEADS JUGOSLAV STATE.—Crown Prince Alexander of Serbia has been appointed Regent of the Jugoslav State by the National Council at Agram, according to a Laibach dispatch. A State Council, comprising all the members of the Agram Council, fifty delegates from Serbia, and five from Montenegro, has been summoned to meet at Serajevo. This council will appoint a cabinet for the Jugoslav State.

It has been decided further that Prince Alexander will appoint Governors at Belgrade, Serbia; Cettinje, Montenegro; Laibach, Slavonia; Serajevo, Bosnia and Herzegovina; Spalato, Dalmatia; and Agram, Croatia. As soon as the situation is settled, elections will be held for a Constituent Assembly, which will sit at Serajevo and definitely decide upon the form of state that will be set up and adopt the constitution.—*N. Y. Times*, 27/11.

AIMS OF CZECHOSLAVS.—Dr. Karl Kramarz was appointed Premier of the Czech Republic on Nov. 19. In an interview with an *Associated Press* representative on Dec. 8, he stated that it was the aim of the Czechs to maintain close commercial relations with Jugoslavs and Rumanians, with a protective wall against Germany. Their goal was to reestablish the frontiers of ancient Bohemia, within which every liberty would be granted, regardless of race.

RUSSIA

ADMIRAL KOLCHAK DICTATOR.—A despatch from Vladivostok on Nov. 19 announced that Admiral Alexander Kolchak, former commander of the Black Sea Fleet, had secured control of the All-Russian Government at Omsk, with dictatorial powers. Admiral Kolchak later received the support of most of the anti-Bolshevik leaders in Siberia, and remained in control at the date of going to press, though not formally recognized by allied representatives.

ATTITUDE OF CZECH FORCES.—The Czechs were greatly surprised by the developments at Omsk, and a special meeting of the Czech National Council has been called at Cheliabinsk to decide what attitude the Czechs shall take toward the new government. While the Czechs do not desire to interfere in internal Russian policies, they are faced by the Bolsheviki on this front, and must protect their lines of communication in the rear.

All their interest is in democratic government in Russia. It is exceedingly doubtful whether they can recognize Admiral Kolchak's dictatorship, but they are in a very unfortunate position, not knowing what attitude the Allies will adopt. It is generally reported in this city and at Omsk that the Allies will recognize the dictatorship. I have been asked repeatedly why the Allies did not recognize the All-Russian Government and bring it the moral support it needed to face the monarchist and Bolshevist agitation. Now it is argued that the Allies did not favor that government because they believed a dictatorship was necessary.—*N. Y. Times*, 27/11.

RUSSIA AT THE PEACE CONFERENCE.—The Government at Omsk, of which the United States and other governments have expected much, is now in the hands of a dictator and split into factions. The Entente nations have not given up hope that the Omsk authorities may yet evolve a stable form

of government for Russia, but this has not been accomplished, and none of the allied governments has recognized the Omsk régime officially, although all of them are dealing with Russian representatives who are in close touch with Admiral Kolchak and his government.

Prince Lvoff, who was Premier in the Kerensky Cabinet and who has devoted most of his life to the development of the Zemstvo system in Russia, and Boris Bakhmeteff, Russian Ambassador in Washington, appointed by Kerensky, as well as Professor Paul Milukoff, Kerensky's Minister of Foreign Affairs, are on their way to Paris or already there with other prominent Russians to do whatever they can to aid the Allies in the solution of the Russian problem. But whether they represent the people of Russia at this time is a question it is privately admitted cannot be answered here.

Far from according any recognition to the Soviet régime at Petrograd, the United States some time ago called upon all civilized nations to condemn the Bolshevist reign of terror.

Even when a set of leaders is recognized as Russian spokesmen, the United States and the Allies must face the great question of how they can be aided in setting up a stable government and in preventing famine, for the benefit of Russia herself, as well as in the interest of the peace of the world.

To aid him in the conferences with the allied leaders, President Wilson has taken a corps of Russian experts with him to Paris.—*N. Y. Times*, 18/12.

MISCELLANEOUS

CHILE AND PERU IN DIFFICULTIES.—During November Chile and Peru again became involved in their old dispute regarding the final disposition of the border provinces of Tacna and Arica, taken from Peru by Chile after the war of 1879-81. The final disposition of these provinces was to be decided by a plebiscite ten years later, which Chile did not permit. On Nov. 25, 1918, it was announced that the two countries had severed diplomatic relations, and early in December both undertook steps toward mobilization. On Dec. 9 it was reported that Peru had accepted the proffered mediation of the United States and Argentina. The following statement was published in the U. S. *Official Bulletin* of Dec. 12:

The American Ambassador at Santiago, Chile, and the American Minister at Lima, Peru, have handed the Presidents of Chile and Peru, respectively the following statement by direction of Acting Secretary Polk of the State Department.

"The President of the United States desires to inform your Excellency that the various incidents leading up to the severance of consular relations between the Republics of Chile and Peru have been viewed by the Government of the United States with the gravest apprehension. Any agitation tending to lessen the prospect of permanent peace throughout the world, particularly on the eve of the convoking of the Peace Conference in Paris, in which it is confidently expected that steps will be taken to provide for an era of lasting peace among all peoples, would be disastrous and those persons who had caused this condition would be charged with grave responsibilities before the world for their actions.

"The President of the United States feels it his duty to draw to the attention of the Governments of Chile and Peru the gravity of the present situation and to point out to these governments the duty which they owe to the rest of the world and to mankind in general to take immediate steps to restrain popular agitation and to reestablish their peaceful relations.

"That a satisfactory and peaceful solution of the matter in dispute between the two countries may be arrived at there can be no doubt and the Government of the United States stands ready to tender alone, or in conjunction with the other countries of this hemisphere, all possible assistance to bring about an equitable solution of the matter."

PRESIDENT OF PORTUGAL ASSASSINATED.—Dr. Sidonio Paes, President of Portugal, was shot and killed by an assassin in a railway station in Lisbon on December 14. The assassin, named Jeetne, was killed by the crowd.

Dr. Paes seized control in Portugal, Dec. 11, 1917, after a comparatively bloodless revolution, which involved no change in Portugal's foreign policy. He was regularly elected president last June, and has given the country a liberal administration.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"The Cradle of the War: The Near East and Pan-Germanism." By H. Charles Woods, F. R. G. S., Lecturer before the Lowell Institute (1917-1918). 357 pages. $2.50 net. (Boston: Little, Brown and Co., 1918.)

This book is neatly named. Truly it was in the Balkans that the cradle was prepared for the war child, and, as the author remarks, the Kaiser diligently rocked the cradle from the moment the child was born.

To drop this rather unmanageable figure of speech, the Balkan peninsula, with its age-old animosities, its heterogeneous and often inextricably intermingled races and religions, its medieval state of civilization, presented before the war, and still presents, one of the most difficult European problems. How reconcile, in these small states, the principle of nationality with the equally important principle of breaking down national barriers and promoting free intercourse, trade, and sea communications in large areas geographically united?

There is no better guide in the study of the Balkan situation than this writer, with his intimate firsthand knowledge, his honesty of purpose, his grasp of the tangled skein of Balkan politics. The only objection is that his book seems rather hastily condensed from voluminous notes, and is not always effectively and attractively written. Not only the interest but also the clearness and force of impression of a book depend more than we realize upon the style.

Like many who know the Balkans well, Mr. Woods, though the staunchest of Britishers, betrays a leaning towards Bulgaria, with her good roads, her relative progressiveness, her hard luck in the Balkan wars. He criticises Allied diplomacy before Bulgaria made her fatal choice, insisting rightly that if the Allies in 1914-15 had adopted a policy "firm, uncompromising, even brutal toward all the Balkan states," Bulgaria could have been kept out of the German camp.

His discussion of the Dardanelles campaign is regretful and apologetic. He argues justly that a British fleet in the Sea of Marmora would have settled Turkey. But in lamenting that a combined operation was not planned from the first, he does not sufficiently recognize the possibilities of surprise naval attack, or even of the attack first made if it had been pushed home.

There is an interesting account of Balkan routes of communication and railroads, both present and prospective. Altogether, if thorough information and fairness of treatment are the main requisites of a good book, this "fills the bill."

A. W.

"Airplane Characteristics." by Frederick Bedell. Price $1.60 net. (Ithaca, N. Y.: Taylor and Co., 1918.)

The publication of this volume of only 74 pages of text may be explained by the following statement in the preface: "Any contribution to aviation, however small, needs to-day no justification." In fairness to the author it should be stated that in addition to the five chapters published, eight are in preparation. Under the circumstances, however, the price at which the book is retailed seems somewhat high.

The book is concerned solely with the theory of flight. Consideration of materials and power plant is rigidly excluded. The subject-matter is very well presented, each principle being discussed in a separate chapter. The five here published deal with Sustentation, Relations in Flight, Resistance, Lateral and Directional Stability. The following chapters are in preparation: Thrust, Power, Climbing, Gliding, Altitude, Single and Multiple Planes, Longitudinal Stability and Stability in General.

In is interesting to compare the first chapter of this book with the opening chapter of the "Aviator's Elementary Handbook" previously reviewed. In the latter the French system of measuring efficiency of a wing section by the percentage of drift to lift is used. Here, on the other hand, the more usual method of comparing wings by the quotient of lift ÷ drift is adopted. As explained in the text, this is more convenient than the French method, as the values of D/L approach infinity when L approaches zero. It is to be hoped that a common standard will be adopted after the war, as at present a good deal of unnecessary labor in conversion is required before the Eiffel, R. A. F., and U. S. A. wings can be intelligently compared.

In the second chapter the following important rule is given: "Velocity equals the square root of loading divided by square root of coefficient of lift." This may be expressed as follows: $V = \sqrt{\frac{W}{SK_1}}$ where V = velocity, W = weight, S = wing area and K_1 = coefficient of lift. It is emphasized that the loading (weight per unit area of wing) affects V rather than the total weight or area, and that *the only way of changing the speed of a machine or of getting different speeds in different machines is by changing the loading or the lift coefficient.* Power has no direct effect on velocity, it merely determines whether the machine climbs, glides, or flies horizontally. Many text-books justly dwell on this simple rule. In Duchêne's "Flight Without Formulæ" it is the very first one given.

Chapter Three considers the question of Resistance, dividing it into two parts: Wing and Parasite. They are considered separately, as wing resistance (or drift) first decreases as velocity is increased, until a certain speed is reached after which it increases; whereas parasite resistance varies approximately directly as the square of the velocity. Charts are given showing the wing resistance with velocity for different conditions of weight and loading. In the section devoted to parasite resistance the importance of streamlining is discussed. It is stated that of the total parasite resistance of an aeroplane, one-third is contributed by the body, one-third by the wires and struts, and one-third by the tail and landing gear.

The last two chapters are given over to a discussion of Lateral and Directional Stability. The point is made that "wash-in" and "wash-out" (progressive increase and decrease of incidence from body to wing tips) used on some British and German aeroplanes to correct for propeller torque tends to make the machine spin when diving with power off and should be avoided.

The book closes with several appendices, including a glossary of aviation terms approved by the National Advisory Committee for Aeronautics, and charts of thrust and power characteristics presumably to be used in conjunction with the chapters in preparation on these subjects. J. J. I.

NOTICE TO MEMBERS

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

G. M. RAVENSCROFT,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership.

....

..................................191

To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. Essays are limited to fifty (50) printed pages in the PROCEEDINGS of the Institute.

6. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

7. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"What Steps in Organization and Training Should be Taken to Maintain and Increase the Efficiency of the Navy at the Close of the Present War."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"The Effect of the Present War upon Views Previously Held of Naval Strategy, Tactics and Logistics."

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

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VOL. 45 FEBRUARY 1919 No. 192

United States Naval Institute
Proceedings

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Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 2 February, 1919 Whole No. 192

United States Naval Institute
Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

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ONE OF THE "FIGHTING RAFTS", 1864.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 45, No. 2 | FEBRUARY, 1919 | Whole No. 192

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

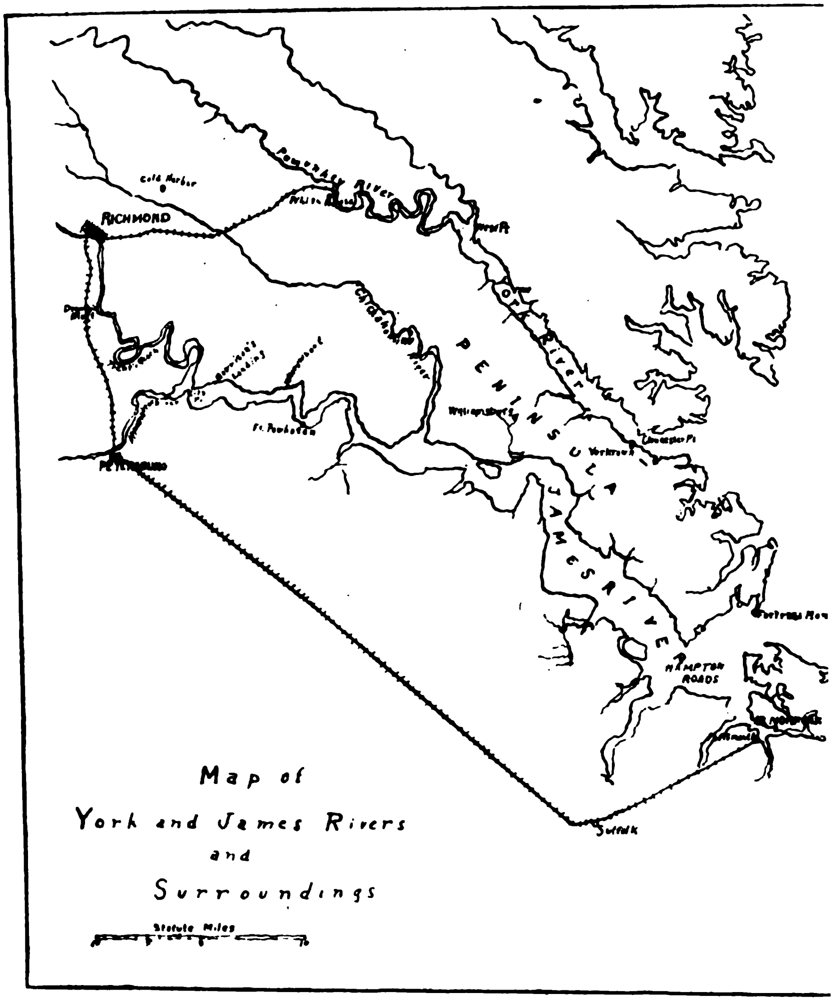
NAVAL OPERATIONS ON THE VIRGINIA RIVERS IN THE CIVIL WAR

By JULIUS W. PRATT, Instructor U. S. Naval Academy

In his treatise, "The Influence of Sea Power Upon History," Admiral Mahan makes a passing reference to the significance to the Southern Confederacy of her numerous inland waterways—the rivers penetrating the heart of her territory and the numberless sounds and inlets that fringed her coasts. These bodies of water, he remarks, which, had the South comprised a seafaring people, naturally disposed to naval activity, would have constituted an element of inestimable strength—for easy transportation, for the concealment and protection of vessels of war, and for secret concentrations against the enemy fleets—these same waterways in reality served as so many gateways through which the dominant naval power of the Federal Government, bringing armies of invasion in its train, entered for her paralysis and eventual overthrow.

The importance of the naval control of the Mississippi and its tributaries in facilitating the land operations in the West has been always and widely recognized; and the work of the Union squadrons in the North Carolina sounds has—largely because of Cushing's sensational feat in torpedoing the ironclad ram *Albemarle*—received considerable notoriety in the histories of the war. But there is one little-noted group of naval operations, performed quietly and for the most part without incidents of a striking

character, which nevertheless had a most important, not to say determining, effect upon two of the major and one of the decisive campaigns in the eastern Confederacy. Without the



steady support of the navy in the Virginia rivers, McClellan's peninsula campaign, if begun at all, would have ended in disaster instead of mere frustration, and Grant's final campaign against Richmond would not only have been beset with enormous diffi-

culties, but must have been fought out on entirely different lines. It would be hard to exaggerate the importance to the safety of the Northern armies of the naval control of these waters; and that control, while never broken, was at times seriously threatened, and maintained only by vigilant and vigorous action on the part of the Northern fleet.

To compare Chesapeake Bay and the James River with the broad waters between our coast and France, or to mention the dozen or so improvised war vessels of the James River Flotilla in a breath with the Allied navies of the present day, may have a touch of the ludicrous. Yet the pygmy flotilla in those narrow waters did for the Union forces in '62 and '64 precisely what the great navies have been doing of late: it made possible the safe movement of troops across waters impassable without its aid, and it kept open the essential lines of communication between those troops and their ultimate base of supplies. If sea power is to be measured not in absolute ship tonnage and weight of guns, but in ability to control essential waterways and thus determine the outcome of wars, then the operations on the James River deserve a place in the history of sea power—a place never hitherto accorded them by even the naval historians.

The most serious danger to federal naval supremacy in these waters came early in the war and at a time most critical for the military plans of the government. It was in March, 1862, that the ironclad *Merrimac* made her sensational appearance in Hampton Roads, where in one afternoon she destroyed two vessels of the blockading squadron and left the others intact only because of darkness and the ebbing tide. The *Merrimac's* sortie was not only a threat at the entire blockade program of the North; it seemed for the moment to have frustrated in a few hours' time the elaborate plans already perfected for the movement of McClellan's army, by water, to Fortress Monroe and the blow at Richmond from that quarter, where the army must be dependent upon a long line of water communications. And it was not until the engagement with the *Monitor* had materially reduced this source of danger that the great convoy carrying McClellan's army moved from the vicinity of Washington to Fortress Monroe.

From the *Monitor-Merrimac* engagement to the end of the Peninsula campaign the Union vessels on the York and James

had no further encounters with Confederate ships, but their dominant presence was none the less important. They not only exercised the same sort of silent yet all-important safeguarding of communications which has in recent times been the chief work of the Allied navies; in addition, their guns time after time rendered the most signal assistance to the troops on shore.

As McClellan, early in May, moved up the narrow peninsula between the York and James, naval vessels kept progress with his march. On the York and its tributary, the Pamunkey, they cooperated with the troops in skirmish after skirmish, cleared the rivers to White House, McClellan's new base, and opened and held his line of communications between that point and Fortress Monroe and Washington. On the James, they advanced to within seven miles of Richmond, where they were at length held by the strong batteries at Drewry's Bluff. They were in position to cooperate more actively with the army had McClellan's advance continued; as it was, a less glorious but no less important rôle was reserved for them—the salvation of McClellan's army after its unfortunate experiences in the Seven Days' fighting.

After a week of indecisive engagements across the head of the peninsula, McClellan, as always seeing his foe double their real strength, decided upon retreat—not upon his old base at White House on the Pamunkey, but upon the James. His first contact with that river was at Malvern Hill, where in the battle of July 1 the naval vessels materially aided him by shelling the reserve positions of the Confederates. On the day of this engagement he wrote to Flag-Officer Goldsborough of the North Atlantic Squadron: "I would most earnestly request that every gunboat or other armed vessel suitable for action in the James River be sent at once to this vicinity." On the same date, Commander John Rodgers, in immediate command on the James, reported to Goldsborough: "The army is in a bad way; the gunboats may save them, but the points to be guarded are too many for the force at my disposal. . . . . To save the army, as far as we can, demands immediately all our disposable force. . . . . Now, if ever, is a chance for the navy to render most signal service, but it must not delay."

The navy did not neglect its opportunity. No sooner had the army arrived at Harrison's Landing, its destination on the James, than Rodgers placed his gunboats and ironclads upon its

two flanks, where they gave the direct protection of their guns as well as the assurance that communications should be maintained. The importance of this work is evidenced by a department order of July 6 designating the James River Flotilla an independent division of the North Atlantic Squadron, a position which it held until the last of August, when the army had been withdrawn from the peninsula and the necessity of controlling the James had ended. Admiral D. D. Porter thus summarizes the navy's work in this campaign: "Without it, the Grand Army of the Potomac could not have been moved so successfully to the Peninsula; and it is scarcely yet forgotten how, in the most trying times, when that army seemed to be in danger of annihilation, the navy was at hand to give shelter under its guns to our retiring and weary troops, and drive back the excited and victorious foe, who would have driven our soldiers into the river, or made them lay down their arms."

For almost two years after the above events the James River saw little of naval activity. While the North maintained a nominal control of the river, little use was made of it other than for an occasional expedition for the destruction of military stores or other contraband. In the meanwhile the Confederates at Richmond were busy mining the river with electric torpedoes and building a fleet of river vessels which it was hoped might meet successfully the next attempt to approach Richmond by water. The *Merrimac*, or *Virginia* as she had been rechristened, had proved of too deep draft to be taken up the river and had been destroyed at Norfolk, but her two wooden consorts, the *Patrick Henry* and *Jamestown*, had steamed to Richmond, there to form a nucleus for the new flotilla. Three new ironclads, of the same general character as the *Merrimac* but in every way lighter, were constructed, and to these—the *Virginia II*, *Richmond*, and *Fredericksburg*—were added the wooden gunboats *Nansemond*, *Hampton*, *Beaufort*, *Raleigh*, *Drewry*, and a vessel referred to as "Davidson's torpedo boat." The difficulties encountered by the Confederates in building men-of-war are indicated by the following bit of description of the *Nansemond* and *Hampton*: "These vessels," wrote a Confederate officer, "had saw-mill engines, and when they got under way there was such a wheezing and blowing that one would suppose all hands had been attacked with asthma or heaves."

But, primitive and inefficient as it was, this "fleet in being," as we shall see, caused great anxiety in the minds of the opposing naval and military commanders in the most important campaign of the war, and detained for service in the James several powerful ironclads which might have been used to advantage at Mobile Bay, Charleston, or Fort Fisher.

In March, 1864, Ulysses S. Grant, now with the rank of Lieutenant General, revived especially for him, was placed in supreme command of the armies of the United States. On the fourth of May he crossed the Rapidan and moved against Richmond. In several weeks of fighting in which he tried repeatedly to encircle Lee's right flank, he met with a series of bloody reverses, culminating June 3 at Cold Harbor. He was on McClellan's old battle ground, scarcely nearer Richmond than when he had begun. But Grant, the very antithesis of McClellan, never recognized defeat. Blocked by an impenetrable wall this side of Richmond, he turned his eye in another direction—Petersburg, south of the James on the southern approaches to the Confederate capital.

Already a minor campaign against Petersburg had been opened by the Army of the James under General Butler, supported by the Union fleet. As far back as April 8 Grant had telegraphed to General Halleck in Washington: "It is the intention to operate up the James river as far as City Point, and all the cooperation the navy can give us we want. Two of the ironclads are wanted as soon as they can be got. You will know how to communicate our wants to the Secretary of the Navy."

In pursuance of this request, Acting Rear Admiral S. P. Lee had on May 5 successfully convoyed Butler's transports from Hampton Roads and landed them without opposition at City Point on the upper James. Seven wooden vessels had been detailed to precede, dragging the river for torpedoes. Closely following came the main column—four monitors and the captured ironclad *Atlanta,* each towed by two gunboats or tugs. Advancing westward from City Point toward Petersburg, Butler occupied a line stretching from Trent's Reach on the James to the Appomattox River, while, at his request of May 13, Admiral Lee's squadron moved up through the curves and shallows of the upper James and took up its position on Trent's Reach, covering the right flank of the army. The movement was attended with

considerable danger. Already two vessels had been destroyed, one caught beneath an overwhelming fire from a masked battery on shore, the other blown up by one of the torpedoes with which the river was veritably studded. "Torpedoes, commanded by rebels on the left bank, which commands our decks," Lee wrote to Secretary Welles, "and shoal water, by chart, by several feet less than the monitors draw, make difficult the advance." Nevertheless, Lee was able to report on the seventeenth that the advance had been successfully accomplished and that the monitors in Trent's Reach protected Butler's flank.

When, therefore, General Grant determined to throw the Army of the Potomac across the James, the southern bank of that river at the proposed point of crossing was already in Union control and the navy was in position to guard the crossings at Willcox's Wharf and Fort Powhatan. Even before the battle of Cold Harbor it is evident from the correspondence of Generals Grant and Butler, Rear Admiral Lee, and the Secretary of the Navy, that the move across the James was contemplated and that the necessity of controlling the river was thereby rendered imperative. On June 1 Rear Admiral Lee had requested that the monitor *Tecumseh*, ordered to sea May 28, be left under his command, and that further reinforcements be sent, because of "the importance of this river to the armies of Generals Grant and Butler." Again on June 3 the same officer mentioned in his correspondence with General Butler the "necessity . . . . of holding this river beyond a peradventure for the great military purposes of General Grant and yourself." And Butler a few days later wrote to Lee: "The necessity of holding our positions here is an 'overwhelming' military one." The absolute necessity of holding the river safe against attack from above is further emphasized by the following passage from Grant's "Memoirs": "It was known," he writes, "that the enemy had some gunboats at Richmond. These might run down at night and inflict great damage upon us before they could be sunk or captured by our navy."

In order to secure control of the river "beyond a peradventure" the military authorities determined upon a course exceedingly distasteful to Rear Admiral Lee. In the last days of May General Butler had suggested that the channel at Trent's Reach be obstructed by the sinking of a half-dozen stone-laden

schooners in the river at that point—a suggestion to which Lee had given qualified assent. He did not, however, relish the idea of barricading his fleet against attack from a presumably inferior force, and on June 2 Butler, in a letter that contains some striking passages, undertook to assuage the admiral's delicacy. "I am aware," he wrote, "of the delicacy naval gentlemen feel in depending upon anything but their ships in a contest with the enemy, and if it was a contest with the enemy's ships alone, I certainly would not advise the obstructions, even at the great risk of losing the river; but in a contest against such unchristian modes of warfare as fire-rafts and torpedo-boats, I think all questions of delicacy should be waived by the paramount consideration of protection for the lives of the men and the safety of the very valuable vessels of the squadron." Lee was not altogether convinced by Butler's argument. He replied noncommittally, and on June 7 he asked instructions from Secretary Welles, transmitting his correspondence with Butler, pointing out that his ironclad force was stronger than Grant had asked for, and adding: "The navy is not accustomed to putting down obstructions before it, and the act might be construed as implying an admission of superiority of resources on the part of the enemy." But Secretary Welles declined to relieve the perplexed admiral of the responsibility of the decision, replying on June 11, "Action in this matter is left to the discretion of the admiral of the squadron, in whom the department has confidence." Between the indecision of Lee and that of Butler, the question dragged along without action, and it was not until the fifteenth, when half the Army of the Potomac had crossed the James, that a peremptory order from Grant led to the sinking of the schooners. In the meantime the safety of two Union armies depended entirely upon Admiral Lee's force of monitors and gunboats.

Why was the Confederate flotilla all this time inactive? Admiral Lee and his officers were in constant expectation of an attack. Confederate deserters again and again reported an attack as imminent. Not only was there hope of cutting Butler's communications and damaging his base, but from June 7 on, Grant's intention of crossing the James was an open secret in Richmond. Why, then, was no effort made to interfere with these vitally important operations? The answer—aside, of course, from the risk entailed by the inferior strength of the Confederate flotilla—

appears to lie in incompetence, in the absence of any resolute, determining will, in the reference of vital decisions to councils-of-war, which notoriously "do not fight."

As early as May 7 Secretary of the Navy Mallory was urging upon the Confederate War Department the need of haste in opening a passage through the old Confederate obstructions at Drewry's Bluff. It was hoped that an advance of the three ironclads down the river would put an end to the mine-sweeping operations of the wooden gunboats and compel the monitors to come forward, where, with good fortune, they might be torpedoed. But the removal of the obstructions was attended with great delay. It was not until May 24 that the *Richmond* and *Virginia* were able to pass the opening, and before that time, as we have seen, the Union flotilla had completed its advance and covered Butler's flank on Trent's Reach.

Flag-Officer John K. Mitchell, commanding the Confederate flotilla, now proposed an immediate attack upon the Union forces below. Fire rafts were to be sent ahead to throw the enemy into confusion; then the ironclads and gunboats, all equipped with torpedoes, were to make their attack in the darkness or semi-darkness of early dawn. Secretary Mallory approved the plan; there seemed some chance of success. But the attack was postponed from day to day. At one time the *Fredericksburg* had engine trouble. At another the shore batteries were unable to cooperate, General Beauregard showing a disinclination to work harmoniously with the naval forces. Lack of torpedoes occasioned further delay. The date of attack was postponed until the thirtieth. On that date Mitchell submitted his plan of attack to his officers, who disapproved it. Finally, on June 8, he submitted the entire question of offensive action to a council-of-war. The council held an attack to be inadvisable because of the strength and disposition of the opposing force, low water, and narrow channels. This report Mitchell submitted to the Secretary on June 13. Two days later the sinking of the obstructions in Trent's Reach rendered all offensive plans for the time being futile. The Confederate navy had lost whatever chance it may have possessed of blocking or hampering Grant's southward movement.

This movement, "the greatest feat of his military career," Grant accomplished with incredible rapidity and secrecy. On

June 14 the advance of his army reached the James. On the seventeenth he was able to report to General Halleck: "Our forces drew out from within fifty yards of the enemy's intrenchments at Cold Harbor, made a flank movement of an average of about fifty miles march, crossing the Chickahominy and James rivers, the latter 2000 feet wide and 84 feet deep at point of crossing, and surprised the enemy's rear at Petersburg. This was done without the loss of a wagon or piece of artillery and with the loss of only about 150 stragglers, picked up by the enemy."

The passage of the James opened the Petersburg campaign, which was to result in the fall of Richmond and the end of the war. The part played by the navy was neither brilliant nor spectacular, but upon it depended absolutely the success of the campaign. Without the naval control of the river, Grant's army could never have crossed in the first place; nor, without that control, could a mile of the long line of water communications between City Point and Hampton Roads have been kept open. The army before Petersburg would have been in an impossible position. Its safety and its hope of success rested with the river squadron, whose quiet work guarded bases and transport lines from the formidable ironclads up the river. That the danger from these ships was no chimera of the imagination was shown when, in January, 1865, they made their last attempt to attack the Union forces. On this occasion they succeeded in breaking through Butler's obstructions at Trent's Reach, and only the presence of the powerful monitor *Onondaga* prevented the inflicting of great damage upon the Union forces.

To the importance of this naval activity on the James we have the testimony of no less an authority than General Grant himself. In answer to an inquiry whether a part of the ironclad force on the James might safely be withdrawn, Grant wrote, in July, 1864: "Whilst I believe we will never require the armored vessels to meet those of the enemy, I think it would be imprudent to withdraw them. . . . . There is no disguising the fact, that if the enemy should take the offensive on the water—although we probably would destroy his whole James river navy—such damage would be done our shipping and stores, all accumulated on the water near where the conflict would begin, that our victory would be dearly bought."

But even such testimony is very far from an adequate statement of the navy's case. The strength of that case is apparent at once if we but ask the question: What if the South instead of the North had possessed the preponderant strength on these inland waters? The answer, of course, is this: Not only would such campaigns as McClellan's and Grant's have been altogether impossible with respect to both the movements of the armies and the maintenance of their communications, but the whole character of the war would have been altered—the South would have possessed the offensive, and Washington instead of Richmond would have sought protection behind obstructions and inferior fleets. It is, of course, a truism that without its fleets the North could never have won the war; but it is high time that the control of the Virginia rivers was recognized as one of the great phases of the navy's work, worthy a place scarcely below the Mississippi operations and the blockade.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE UNITED STATES NAVAL INSTITUTE

By Rear Admiral Bradley A. Fiske, U. S. Navy (Retired)

It is an old story of the navy that a captain of the forecastle once brought a captain of the head to the mast to make a report against him; and that when the officer of the deck inquired what was the nature of the offence, the captain of the forecastle answered, "Why, sir, he don't take no pleasure in his work."

The story is supposed to be amusing, from the fact that the duties of the delinquent were not such as would be expected to give a man much pleasure; but it is instructive, because it shows that the experience of the captain of the forecastle had taught him that men do not usually do their work well, unless they take pleasure in it.

There are, of course, many kinds of pleasure; but it is the experience of most men past middle life that there is no pleasure more lasting, or more certain to be realized, than the pleasure of doing work, if one does it well. Other pleasures may be keener; but, on the general principle that one always has to pay for what he gets, pleasures that are pleasures merely, especially pleasures that are keen, are usually expensive in some way; whereas, the pleasure of doing work well is automatically paid for by the doing of the work.

Now, one of the functions of the Naval Institute is to present the problems of the navy in such a way as to make officers see how much variety and interest they possess, and how much pleasure can be secured by working on them. Without some such stimulus as the Institute, the navy would be less like a profession and more like a trade; we would be less like artists, and more like artisans; we would become too practical and narrow; we would have no broad vision of the navy as a whole, each one

of us would regard his own special task as the only thing that concerned him, and would lose that sympathetic touch with his brother officers which all of us now enjoy.

The Naval Institute is a club at once social and professional, which is not restricted to any club-house on any avenue in any city, but which spreads over all the oceans to all of our ships and stations, down even into the depths of the sea where our submarines lie, and ten thousand feet into the air where our aeroplanes fly. It is the embodiment of the thought of the navy. It is the unofficial custodian of the navy's professional hopes and fears. It looks ahead into the future, and back into the past, and keeps track of the happenings of the present.

During the forty-five years that have elapsed since Admiral Luce wrote the first article in the first number of the Naval Institute, the Naval Institute has been the most stimulating single agency that has existed for the development of an American navy; for, while the official publications of governments, and the official reports concerning their activities, are our surest sources of information as to what other navies are doing, yet their only usefulness to us, is in showing us what foreign ideas we should adopt; whereas the Naval Institute enables officers to look into the great beyond, and discuss and perhaps develop ideas of their own on original American lines. Officers are officially responsible for the discharge of their official tasks, and are of necessity compelled to strict reticence concerning them; but the Naval Institute, by reason of its unofficial character, enables them to get out of the rut of the actual sometimes, and soar among the glories of the possible.

In the early days of the Naval Institute, it was ridiculed by a large class of naval officers, who called themselves "practical." They were practical, but that was all. To them, the whole of the naval profession was comprehended in the practice of the various drills and exercises in gunnery, seamanship, navigation, etc., which they saw in any ship. Their highest ideal of an officer was a man who performed those duties well.

All honor to those sterling men, but how limited was their vision! Not only did they fail to foresee the great advances about to be made in their profession by the "theorists" whom they contemned, but they also failed to see that the very arts which they then practiced owed their actual existence to the class

of men they stigmatized. They failed to see that the very ships which they sailed so boldly, could not have carried them over the seas if " theorists " had not theoretically ascertained the laws of buoyancy and propulsion, and applied those laws to the making of engines, sails and ships. If the naval profession were like that of breaking stones along the road, those officers would have been right; because each officer after " learning his job " would have been able to practice it thereafter in a thoroughly practical and efficient way; just as a man can break stones on the road day after day, in a thoroughly practical and efficient way. What those brave and forceful, but partially blind, men failed to see, was the intellectual future of all navies, and the consequent necessity of enlisting in the service of our navy the various intellectual faculties of men; and of assisting those faculties with whatever aid the literary art might give; in order that our officers might have placed before them in the most inspiring form as many and as good problems, suggestions, and ideas as possible.

For many years, the Naval Institute maintained a precarious existence; and it was not until within the last, say fifteen years, that it became thoroughly established in good favor. Doubtless, one element in assisting it has been a realization of the fact that, in the competitive race for excellence which navies have been holding, the use of scientific instruments and methods might have a determining effect. This competition still exists, with abundant indication that it is going to continue to exist.

One of the factors which has handicapped the Naval Institute has been a curious shyness about writing articles for it. This shyness existed much more in the past than it does now; but it still exists to a degree that is really lamentable. Scores of times I have said to some officer who had made some suggestion, or described some instructive experience, " You ought to send that to the Institute," and he has answered, " But I can't write." Now, *any man who can think can write*. Writing is merely recording. If a man has anything to record, writing can record it.

The so-called faculty of writing is not so much a faculty of writing as it is a faculty of thinking. When a man says, " I have an idea but I can't express it "; that man hasn't an idea but merely a vague feeling. If a man has a feeling of that kind, and will sit down for a half an hour and persistently try to put into writing what he feels, the probabilities are at least 90 per

cent that he will either be able to record it, or else realize that he has no idea at all. In either case, he will do himself a benefit.

So far, in this article, it has been assumed that the articles of the Naval Institute are, or ought to be, extremely serious. Possibly, most of them should be; life itself is mostly serious, and so is naval life, and so should be the Naval Institute. But life is not wholly serious; and the most useful lives have usually been lives in which the strain of serious work was relaxed by frequent recreation, and brightened with wit and humor. Possibly, the Naval Institute has too large a proportion of seriousness in its pages, and this is my individual opinion. But this is not the fault of the Institute; because the Institute has made persistent efforts to induce officers to write of any exciting or amusing experiences they might encounter. The lack of success which the Institute has met in getting due response has not been only amazing but deplorable. Why should officers hesitate to write in the NAVAL INSTITUTE PROCEEDINGS of those exciting and funny experiences which naval officers have in a greater degree than do any other men in the world?

The Naval Institute has been of inestimable value to the navy in the past, and it can be made to be of inestimable value to the navy in the future. Whether it shall be so or not will depend on United States Navy officers. The degree of support which they give to the Institute by contributing to its maintenance, by reading the articles it prints, and by writing articles themselves, will determine the amount of good which the Institute can do to the navy. It is the duty of every officer, therefore, to do his utmost to support it.

The Navy of the United States is now embarking on a career of greater importance and splendor than it even imagined a few years ago. No one thing can guide and brighten its path more wisely and more happily than a properly supported and encouraged Naval Institute. "Cast thy bread upon the waters, and it will return to thee after many days."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OUR NEWEST NAVY

HOW ITS COST IS BEING DETERMINED

By Captain David Potter, Pay Corps, U. S. Navy

I

Several hundred vessels of our newest navy—vessels of types from battle-cruiser to mine-sweeper and to torpedo-testing barge—are being constructed at more than a score of civilian shipyards. These vessels are being built, so far as concerns matters of cost, upon a basis of their actual cost plus a profit on such actual cost.

The administration of the matters of cost under these cost-plus-profit contracts has been entrusted by the Secretary of the Navy to a group of officers called the Compensation Board. In accordance with a nomenclature first used by the Bureau of Supplies and Accounts, the name "Cost Inspection" has been given to the work performed under the cognizance of the Compensation Board. This cost inspection has already attracted the earnest attention of shipbuilders, of producers of raw materials, of economists, of financiers, of fiscal officials, and of accountants.

Some reasons for this wide interest will be found in a brief account of cost inspection set forth in this article. The cost inspection herein referred to has no connection with any determination of costs arrived at by the United States Shipping Board, Emergency Fleet Corporation, for vessels being built by and for that corporation—the navy is not charged with supervision over the construction or the costs of construction of the vessels of the Emergency Fleet Corporation.

Let him who ventures to read further take heart of grace! Here he shall find no cryptic "graphs" or diagrams, no co-ordinates or abscissæ marking cost-curves better left unplotted. He shall find few arrays of figures, and none of them appalling. Those phrases, melodious to certain ears—interest on investment,

deferred charges, shop cost, day rate, piecework, machine rate, non-productive labor—shall ring not at all in these pages. There will here be found almost none of the jargon of the schools of accountancy.

II

I fancy that every explorer in a new land has a peculiar pride in his discoveries in that land, quite aside from the charm he finds in the contour of its landscape or in the sweep of its rivers. The sense of something achieved that filled the soul of Columbus in his discovery of America, of Cortez in his conquest of Mexico, of da Gama in his rounding of the Cape of Good Hope, must have been well-nigh divine. So, too, Newton's understanding of the significance of gravity, Watt's realization of the potentialities of steam, or Whitney's invention of the cotton gin, was, in its way, almost as soul satisfying. Hardly less so, to the persons concerned, were the conclusions of Taylor and Gantt in regard to scientific management, and the exposition by Hamilton Church of the advantages of the use of the capacity-factor in the prorating of indirect expense.

Boldly to compare, therefore, the explorations of the members of the Compensation Board and of the officers of the bureaus with the explorations of other men, perhaps there may be conceded to the officers concerned the right to feel that something has been achieved by their initiation of cost inspection in this country.

The Secretary of the Navy, by his order of March 22, 1917, and supplementary orders issued from time to time, organized the Compensation Board—made up of representatives of the Line, the Construction Corps, the Civil Engineer Corps, and the Pay Corps. The department directed the board, first, to ascertain, estimate, and determine, in accordance with the terms of contracts, the actual costs of vessels building or about to be built under contract with the Navy Department, on a "cost-plus-profit" basis; second, to decide upon, control, and supervise the execution of all methods necessary to be established to carry out its duties, especially those defined in the contracts for vessels building or to be built upon the "cost-plus-profit" basis.

The Compensation Board at once requested the Bureau of Supplies and Accounts to call upon officers of the Pay Corps ex-

perienced in accounting to make recommendations as to methods of cost inspection. These recommendations were promptly submitted. After consideration of the various plans proposed, the Compensation Board formulated general instructions under which cost inspection has since proceeded.

In addition to the indispensable aid of the officers of the regular Pay Corps, the Compensation Board has received the self-sacrificing assistance of a group of professional accountants and financiers—able and accomplished officers commissioned in the Pay Corps Naval Reserve Force and assigned to duty with the Compensation Board. Officers of the Bureaus of Steam Engineering, Construction and Repair, Yards and Docks, and Supplies and Accounts, as well as the jurists of the office of the solicitor for the Navy Department, have also furnished invaluable help.

III

Prior to March 22, 1917, vessels built for the navy at civilian shipyards were built on a fixed-price basis. A torpedo-boat destroyer, exclusive of armor and armament, used to cost the navy from $550,000 to $900,000. A battleship of the first class cost the navy from $4,400,000 to $7,500,000. These prices, of course, represented expenditures made by the shipbuilder for direct labor and for direct material, plus indirect expense, plus his profit. What amount of a shipbuilder's fixed-price to the navy was profit was not known to the navy, although close estimates were made by the navy's representatives. It is not unreasonable to say that even if the shipbuilder knew pretty closely what expenditures he had made for direct labor and for direct material, he did not know how much of his selling price was overhead and how much was profit. The price the shipbuilder fixed to the navy was, at best, only an estimate, the estimate based on "experience" or "judgment," which, being interpreted, too often signified only a guess.

The increasing cost of raw materials and the increasing cost due to high wages paid to employees resulted in the prices named by the shipbuilders to the navy reaching a very high figure. Indications of the inevitable result of these increased prices asked by the shipbuilders from the navy were given again and again by the Navy Department. These indications were given not only in the form of tenders renewed and rejected, but, specifically, in

the form of requests from the Navy Department to shipbuilders that lower prices should be offered, if possible.

But induced by what they believed to be economic necessity, and inspired by motives of self-protection, the shipbuilders who were accustomed to construct naval vessels continued to make tenders only of prices unacceptable to the Navy Department. The Navy Department became convinced that the prices demanded by the shipbuilders were unnecessarily high—that the percentages to cover contingencies were greater than the contingencies would actually require.

It is certain that it was the duty of the Navy Department, while affording shipbuilders opportunity to earn a reasonable profit, at the same time to protect the interests of the government to the fullest extent of its powers. This duty it has performed to the utmost.

By the act of August 29, 1917, under the heading "Increase of the Navy," it was provided,

> That if, in the judgment of the Secretary of the Navy, the most rapid and economical construction of the battle cruisers authorized herein can be obtained thereby, he may contract for the construction of any or all of them upon the *basis of actual cost, plus a reasonable profit to be determined by him.*

As brief as the above quoted lines are, they mark the granting of a power to the government which was to result in revolutionizing the financial and accounting features of the construction of naval vessels at civilian shipyards. It is possible, even, that a revolution was begun in the whole economic situation of the shipbuilding industry. The above-quoted provisions of law were supplemented by certain vital provisions in the act of March 4, 1917, the act of October 6, 1917, and the act of July 1, 1918. It is the appropriate provisions of the respective naval appropriations bills which made possible the construction of naval vessels at private shipyards on the basis of actual cost plus an agreed-upon amount of profit.

IV

During the autumn and winter of 1916 and the winter and spring of 1917, the Navy Department, and its duly authorized representatives, were engaged in endeavoring to persuade what may be called the "old-line" shipbuilders to agree to construct

naval vessels at an acceptable fixed-price. Failing this, the Navy Department endeavored to agree with the shipbuilders upon a proper cost-plus-profit basis upon which to proceed with the work of construction.

For several years, a considerable amount of ordinary building-erection has been done in America on a cost-plus-profit basis. It is evident, however, to anyone who has knowledge of shipyard work that ordinary building-erection on a cost-plus-profit basis is a very different thing from the construction of vessels on the same basis. Without entering into details, it is believed that this will be conceded.

Since the beginning of the European war, in 1914, and in a few sporadic instances before that time, certain civilian steamship companies had had vessels constructed at civilian shipyards on a so-called cost-plus-profit basis. The word "so-called" is used advisedly, since checking of such costs, either by the shipbuilder or the steamship company, was little more than nominal. The steamship companies had no, or at least very inadequate, machinery for verifying the records of cost presented by the shipbuilders. Further, except for approximately correct records of direct labor and direct material charges, the records of cost of the shipbuilder, as presented to the steamship company for payment, were little better than estimates. In fact, such records had all the joyous freedom from restraint of an ordinary fixed-price contract.

In a word, almost no precedent existed in America for the determination of costs of vessels being constructed on a cost-plus-profit basis.

It may be noted, in passing, that since the beginning of the European war, a vast amount of naval construction has been done in Great Britain on a cost-plus-profit basis. It is interesting to note, further, that such method of construction in Great Britain, on the whole, is not regarded by the British authorities as a success, so far as keeping down costs is concerned. Examination of British records in the case indicates, however, that this feeling of failure is not so much due to the fact that costs have been excessive—if, indeed, they have been—but is due to the difficulties encountered by the British authorities in satisfactorily checking the records of costs. Upon perusal of the British hearings, it is not certain, as a matter of fact, that costs have not

been satisfactorily checked; but the feeling of dissatisfaction seems rather to have arisen from the difficulty found by government representatives in making clear to the committees of parliament that costs have been adequately checked.

V

For the purposes of the present consideration, there are four practicable divisions of contracts. The differences between the four kinds are sufficiently well defined in the report of a subcommittee of the Inter-Departmental Cost Conference. This conference was composed of representatives of the Department of Commerce, of War, of Navy, of the Federal Trade Commission, the Council of National Defense, and the War Industries Board. A sub-committee of the Inter-Departmental Cost Conference drew up a report known as "Remarks on Contracts" (July 31, 1917). As this is a clear exposition of the advantages and disadvantages of the four different kinds of contracts, some part of the remarks is quoted.

A. THE FIXED SUM CONTRACT

By this is meant the form of contract in which the contractor, generally in competition with other contractors, bids a fixed lump sum for the furnishing of supplies or the performance of services (other than personal) under conditions laid down by the government.

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To summarize then—this form of contract has the advantage of simplicity but has the disadvantages of establishing a diversity instead of a community of interest between the government and the contractor, of demoralizing the supply and prices of raw materials, and of requiring increased time to secure competition.

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B. THE COST PLUS A PERCENTAGE CONTRACT

This form of contract involves the complication and expense of requiring that the government itself determine, or at least check with considerable accuracy, the actual costs to the contractor.

It enforces upon the government the necessity of supervising the contractual relations between its main contractor and his sub-contractors, for it is to the advantage of the main contractor to make his sub-contracts cost as much as possible.

It offers every inducement for the contractor to inflate his costs, and there are an almost infinite number of ways of doing this; the temptation

for the contractor is to inflate both his actual costs in every respect, and the cost he reports to the government.

Assuming that the above objections can be met, it has the advantage of protecting the government from excessive prices without demoralizing the prices and supply of raw materials, and of saving time.

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To summarize—this form of contract has the advantages of saving time and preventing demoralization of markets, but has the disadvantages of establishing a diversity instead of a community of interest between the government and the contractor, of involving the government in the expense and trouble of determining or checking contractor's costs, of supervising his relations with sub-contractors and of giving rise to contentions between the government and the contractor that may be very troublesome during the contract and for many years thereafter.

C. The Cost Plus a Lump Sum Contract

In this form of contract the actual cost to the contractor, determined or checked by the government is paid to the contractor, plus a definite lump sum, which, in the judgment of the contracting officer, is a reasonable reimbursement to the contractor for the employment of his services, plant, and organization in producing the desired product for the government.

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Once this lump sum has been determined and accepted by the contractor, the contractor is under no inducement to inflate his actual costs, though he may still be tempted to inflate his reported costs to the government. His costs must therefore be determined or checked by the government as in "B," above. Neither is he under any inducement to keep his costs low—in short, in so far as the real costs are concerned, he occupies a neutral position.

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To summarize—this form of contract has the advantages of saving time and preventing demoralization of markets. It establishes neither a diversity nor a community of interests between the government and the contractor. It involves the government in the expense and complication of determining or checking the contractor's costs, and may involve some supervision of sub-contractual relations, although not so much as in "B." . . . . Assuming that the difficulties in determining the contractor's costs can be met, it appears to be a satisfactory form of contract.

D. The Cost Plus a Lump Sum With Limited Penalty and Bonus Contract

In this form of contract a preliminary estimate is made by the contracting officer as in "C," or by the contracting officer and contractor in agreement. A lump sum consideration is fixed by the contracting officer as in "C," on the basis of the estimated cost. The contractor is informed of or agrees to the estimated cost and the lump sum consideration. If the actual cost

after the work is done is just equal to the estimated cost, the lump sum consideration is paid, exactly as in "C." However, if the contractor is able to reduce the actual cost below the estimate, any reduction is shared half and half between the government and the contractor, provided that the contractor shall not receive more than a certain maximum. On the other hand, if the actual cost exceeds the estimate, half the excess is carried by the government and the other half is deducted from the lump sum compensation that was the basis; provided again, that the contractor's profit shall not be reduced below a certain minimum.

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In this form of contract the contractor is again put practically on a salary and rental basis, but with a penalty and bonus provision that brings about a community of interest between him and the government, so safeguarded that unduly excessive profits to the contractor are prevented and also so as to ensure that he neither loses money on account of his work for the government nor finishes without any compensation whatsoever. The contractor has every reason to reduce his actual costs, and so far a community of interest has been established. On the other hand, he has the temptation of inflating his reported costs to the government. It will therefore still be necessary for the government to check or determine costs, as in both "B" and "C."

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To summarize—this form of contract saves time and prevents demoralization of markets. It establishes a community of interests between government and contractor. It involves the government in the expense and trouble of determining or checking contractor's costs, but involves no supervision of sub-contractual relations, since the contractor's interests and the government's are identical so far as keeping down costs of subcontracts are concerned. Assuming that the difficulties in determining contractor's costs can be met, it appears to be a satisfactory form of contract.

The first group of contracts for the construction of our newest navy, as entered into by the Navy Department, is the cost-plus-ten-per-cent-profit style of contract. In view of the fact that, as has just been indicated, this contract has been regarded as perhaps the least desirable of the three kinds of cost-plus contracts, from the government point of view, it may be asked why the Navy Department entered into a cost-plus-ten-per-cent-profit contract in preference to a fixed-profit-on-a-sliding-scale contract. The answer to such a question is complete and twofold: First, the cost-plus-ten-per-cent-profit contracts were formally entered into in April, 1917, and actually were agreed upon by the middle of February, 1917, before as much was known of the relative advantages and disadvantages of the different kinds of practicable

contracts as is now known. Second—perhaps the more important reason of the two—the policy of the Navy Department at that time made the cost-plus-ten-per-cent-profit contract preferable to all others—in fact, made its adoption inevitable.

VI

Governance is one of the most difficult and delicate arts in the world. In its last analysis, the tools and instruments of administration are persons—hence, machine action can never be counted upon from them. In all important situations, the psychology of human beings must be considered. Governance can, therefore, never be a science, but must ever remain an art. It is hoped that the expression of these facts here will not be found platitudinous in considering the reasons for the adoption of the types of contracts entered into by the Navy Department with the shipbuilders.

For many years past, the orders placed by the Navy Department with the principal civilian shipyards for the construction of naval vessels had furnished the very backbone of the "old-line" shipyards' business. Such orders enabled the shipbuilders to stabilize their laboring force, to assure sub-contractors of a reliable market for fabricated articles entering into naval vessels, and to constitute a steady demand for the producers of raw materials. Such orders have been a financial guarantee to the stockholders of the respective shipbuilding companies, since they represented work upon whose completion no such thing as a bad debt existed out of all of the millions involved, because the debtor was the United States Government itself. It will thus be seen that the shipbuilders owed a particular responsibility to the Navy Department and, in fact, owed a very great and very particular debt of gratitude to the Navy Department because the department had enabled the shipbuilders to carry on their business in good times and bad times alike.

On the other hand, the maintenance of an efficient shipbuilding industry was of primary importance to the Navy Department, and to the nation. Commerce, industry, and agriculture itself, are alike dependent, directly or indirectly, upon the ships that sail the seas. While our interoceanic commerce-bearers are usually spoken of as negligible in quantity, they are so only relatively to the seagoing vessels of certain other nations and relatively to

the vast quantity of goods transported overseas from this country. Actually, the interoceanic tonnage of this country is very great. More important is the fact that our coastwise trade is, by law, carried on in our own bottoms and that these bottoms are, by law, made in America. For the construction of these vessels, a sound shipbuilding industry is essential. It is vital, therefore, that the government, which is only the people itself, should take the necessary measures to sustain, at all times, an adequate shipbuilding industry. As part of this industry, it is necessary that men-of-war should be built sufficient in number and size and quality to sustain and protect the national policies in all parts of the world.

In harmony with these ideas, it is vital for the Navy Department to make sure that the price at which naval vessels are built for it by civilian shipbuilders should represent not less than the actual cost, not less than a reasonable profit. While the Navy Department uses records of costs secured in the course of the construction of men-of-war at navy yards to check up and to correct the claims of civilian shipbuilders, yet, at the same time, it uses the navy cost-records to justify its allowance to civilian shipbuilders of such price as may be agreed upon. In the case of the policy of the cost-plus-profit contracts now before us, the Navy Department believed it to be necessary—particularly in view of the national and international emergency then existing—to make such arrangements with the shipbuilders as fully to protect the government, and not less fully, to protect the interests of the shipbuilders. Even more, it seemed necessary to err, if at all, on the side of liberality to the shipbuilders, in order that the work might proceed with the utmost possible dispatch and with the utmost cordiality of feeling.

VII

Having in mind the above outlined considerations as to the protection of the government's interests, and, per contra, the considerations as to the protection of the shipbuilders' interests, the Navy Department, so far as concerns the construction of new vessels, entered into contracts on a basis of cost-plus-ten-per-cent-profit. These contracts are of a sort that any disinterested person must concede to be not illiberal toward the shipbuilders. The terms of these contracts allow as actual costs various items which, under ordinary circumstances, are considered only as proper

charges against a profit and loss account, and, hence, not reimbursable to the shipbuilder or manufacturer. Some of such items are interest, rent, selling expenses, and taxes of all kinds, excepting those imposed by the United States Government. By the terms of the contracts, the cost of these items, plus ten per cent thereof, must be allowed as part of the compensation to the shipbuilders.

It must be understood that the cost-plus-ten-per-cent contract was entered into only after very extended discussion between the Navy Department and the "old-line" shipbuilders, and between both of these groups and the proper committees of congress. If anyone should care to investigate the matter, he would find innumerable pages of discussion published in the Hearings of the Committee on Naval Appropriations, House of Representatives, of the Session of 1915-1917. He would there find that the shipbuilders proposed that a contract be entered into on the basis of the actual-costs-plus-sixty-five-per-cent of the direct labor—this sixty-five per cent to cover overhead and profit. So evident is it that the adoption of this method would have immensely simplified the tasks of the government in checking costs—since much of the contentious question as to what is or what is not overhead would have been removed—that one may well wonder why this arrangement was not at once agreed to by the department. There were various reasons of policy, as already referred to, but, in addition, there was the fact that the shipbuilders, for the most part, were unable to make clear to the Navy Department how much of the sixty-five per cent was profit.

The above circumstance is not so remarkable as one who has not had actual experience with the accounts of even the largest corporation might imagine: I think it is not too much to say that it is only the unusual company which has an accounting system satisfactory to anyone but itself, or which can clearly show to outsiders or even to its own officials what are or what are not the actual costs of its own product. The hearings above referred to would make clear to anyone who should read them that the Navy Department and the shipbuilders' discussions were at cross purposes, or, at least, that their points of view could not, at that time, be made to harmonize as expressed in the terms of any other form of contract than the one finally adopted: viz., contracts upon a basis of actual cost plus ten per cent profit thereon.

It is worth while noting that the cost-plus-ten-per-cent-profit form of contract soon gave way to the cost-plus-fixed-profit form. As a matter of fact, only a relatively few of the total number of vessels have been constructed under the all-inclusive cost-plus-ten-per-cent form—by far the larger number are now being built under the superior cost-plus-fixed-profit form. Of this, more hereafter.

VIII

Examination of the terms of a contract for the construction of ships on a basis of cost-plus-profit will show that the Compensation Board, as representatives of the Navy Department, is charged with four distinct sets of duties. The first duty is that the Compensation Board shall control the method of checking costs and shall ascertain the correctness of such costs. The second duty is that it shall satisfy itself that the prices charged by the shipbuilders for material are the lowest possible market prices obtainable, having in view the necessity for speedy delivery and the necessity for the delivery of material of the proper quality and quantity. The third duty is to determine what additional facilities a shipbuilder must have to carry out naval contracts and to allow the expenditures necessary to construct such facilities or a part of them. The fourth duty is to appraise the value of such facilities after the completion of the contracts.

It will be evident that when scores of naval vessels are being constructed with the utmost possible dispatch and when expenditures will eventually run considerably over $1,000,000,000, the Compensation Board, having its headquarters in Washington, can itself do no more than supervise and decide upon the actions necessary to keep account of costs. The task might have seemed almost insuperable except that the navy had already within its organization various agencies which could at once be employed upon matters of cost inspection.

Line officers of the navy skilled in steam-engineering have often been pioneers in all matters connected with marine engines and propelling machinery for vessels. The constructors of the navy are not approached by any part of the civilian world in their knowledge of ship design and of the actual construction of ships. The civil engineer officers of the navy stand, in regard to all phases of civil engineering, in the same position as do the naval

constructors in regard to ship construction and the navy engineers in regard to propelling machinery. The fourth group of officers in the navy possesses a kind of knowledge even more necessary for the proper conduct of cost inspection. Indeed, without such knowledge, cost inspection could not be conducted. This knowledge is that of the officers of the Pay Corps of the navy in regard to prices of material, handling of material, and cost accounting.

Thus already equipped with superintending constructors, with inspectors of machinery, with civil engineers, and with cost inspectors, the Compensation Board was ready to proceed with the establishment of a proper procedure for cost inspection. At each of the shipyards concerned, the officers above referred to were formed into a Cost Inspection Board. The respective Cost Inspection Boards are the instruments through which the Compensation Board works—the Compensation Board has no direct communication with the respective shipbuilders, except as such shipbuilders may personally present themselves in the office of the Compensation Board for information.

At the respective shipyards, the supervising civil engineer is not a member of the Cost Inspection Board, but is a member of a subsidiary board, known as the Plant Board. Each Plant Board is made up of a supervising civil engineer and of the resident cost inspector, this Plant Board being responsible directly to the local Cost Inspection Board, and thence to the Compensation Board.

It is to be observed that the superintending constructor is responsible for matters relating to fabrication of hulls of vessels; that the inspector of machinery is responsible for matters relating to the machinery of vessels; that the civil engineer (as a member of the Plant Board) is responsible for matters relating to construction of buildings, building ways, etc., and that the cost inspector is responsible for matters relating to the actual inspection of costs and to the proper records and reports appertaining thereto. Each of these officers is responsible for his own group of work, but each accepts the information acquired by the others as being as authentic as his own. They meet together for final settlement by themselves, sitting as a Cost Inspection Board, of such matters as can be agreed upon, or for making final recommendation from themselves, as a Cost Inspection Board, to the

Compensation Board at Washington, which latter board is the final board of decision.

Observe, also, that each of the members of the Cost Inspection Board has a competent office force. The persons attached to the offices of the superintending constructor and inspector of machinery are skilled draftsmen, and similar persons, suitable for design and inspection of hull material, or of machinery material, as the case may be. Of particular interest is the constitution of the cost inspector's office. His officer-personnel includes several assistants who have lately been certified public accountants or have had similar experience, and also includes the usual clerks who have had experience in the accounting offices at the navy yards. The force also includes "outside men," competent to investigate, on the spot, such matters as require correction in relation to the number of laborers that may be employed on a given job, or in relation to the methods of handling material intended for use in government work.

The Compensation Board has necessarily worked through its agents, the Cost Inspection Boards. The performance of duty of these officers has been beyond praise. To their resourcefulness, persuasiveness, and pertinacity, to their resolution and intelligence, the success of cost inspection is largely due. The success of cost-plus-profit contracts depends upon the efficacy of inspection of costs. In the rigorous and thorough-going character of its cost-inspection the navy has been notably fortunate.

IX

It is worth while emphasizing here that the only kind of cost-plus contract under the cognizance of the Compensation Board is the cost-plus contract for the construction of new naval vessels. This kind of contract is under the cognizance of the Compensation Board, but the organization of the cost inspector's office, the details of the accounts kept, and all similar matters, are handled by the Bureau of Supplies and Accounts. The officers of the Pay Corps concerned have, also, the same responsibility to their bureau in regard to the technic of their profession as the superintending constructor and inspector of machinery have to their respective bureaus.

Cost inspection under contracts for repairs to naval vessels, for repairs to vessels seized from the enemy, for repairs to

merchant vessels taken over as naval auxiliaries, for the manufacture of ordnance material, for the manufacture of aeroplane parts, for the manufacture of machinery, or for any other repair or manufacturing purposes, is not under the Compensation Board. Cost inspection under contracts for repairs or manufacture—as distinguished from contracts for the construction of new naval vessels—is under the cognizance of the Bureau of Supplies and Accounts and the Bureau of Construction and Repair, the Bureau of Supplies and Accounts and the Bureau of Steam Engineering, and the Bureau of Supplies and Accounts and the Bureau of Ordnance, as the case may be.

So far as the observance of correct accounting principles is concerned, and so far as ease and simplicity in their operation go, the form of the contracts for manufacturing work is greatly to be preferred to the form of contracts for the construction of new vessels. The cost-inspection of manufacturing contracts has been carried on with the same success as has attended the cost-inspection for the construction of new vessels. Since, however, manufacturing contracts are not under the cognizance of the Compensation Board, the details need not be dwelt upon here. It should be borne in mind, however, that the Bureau of Supplies and Accounts is conducting cost inspection at several hundred manufacturing plants and that such work is distinct from the work of the Compensation Board.

X

The instructions of the Compensation Board to the various Cost Inspection Boards, as approved by the Secretary of the Navy, do not prescribe a standard system of cost-accounting, nor do they authorize, strictly speaking, the keeping of a cost-accounting system by the cost inspector. The terms of the contract provide "that no changes in the methods or principles of keeping account of costs shall be required, provided the department finds such principles and methods adequate for the determination of actual costs." Unless, therefore, there is found, from time to time, charges against the government account that prevent a true record of costs being kept, no change is made.

This acceptance by the government of the shipbuilders' methods and principles of keeping account of costs was necessary, in the first place, because the upsetting of the shipbuilders' cost-account-

ing system would have made very grave financial and industrial confusion in the shipbuilders' works, and, in the second place, because of the fact that the government did not have at hand a standard cost-accounting system entirely applicable to civilian shipyards. The standard navy-yard cost-accounting system is complete and works efficiently—it is complete but not entirely satisfactory to the officers of the Pay Corps of the navy, because of the fact that the peculiarities arising out of the government's system of appropriations prevent a thoroughly satisfactory navy-yard cost-accounting system being established. As a consequence, since, up to the date of the establishment of cost inspection, the navy had not been concerned, except indirectly, with the cost-accounting systems at private shipyards, a standard system was not at hand that could be established at private shipyards without delay. However, the decisive consideration in this matter was the one first named, viz., that to establish a new cost-accounting system in the shipbuilders' yards was to produce, for a vital period, very grave financial and industrial confusion in the shipbuilders' plants.

On the other hand, the experience gained by the officers of the Pay Corps of the navy from their handling of navy-yard cost-accounting systems had thoroughly equipped them for the understanding of cost-accounting in general. Hence, while the cost-accounting systems at the different civilian shipyards are almost as numerous as the shipyards themselves and while some of them cannot be said to be satisfactory even to themselves—yet none of these systems has presented any mystery to the understanding of the Cost Inspection Board concerned.

The Compensation Board, under the instructions of the Navy Department, therefore, authorized the Cost Inspection Boards at the civilian plants to carry out what it denominated as a selective and corrective check of the contractor's records of costs and of the actual physical transactions he carries on. In other words, the government expressly avoids duplicating the shipbuilder's cost-accounting records. What it does is to have full access to all the cost records, as well as to the physical operations, of the shipbuilder, and to check up by an extensive system of selected matters the correctness of his whole procedure, and to correct by this selective check such inadvertences in the shipbuilder's records or methods of procedure as may be discovered.

XI

In order to expedite the construction of naval vessels, it was necessary that practically all the shipyards concerned should greatly increase their plants—both buildings and equipment. At once, the shipbuilders pleaded financial inability, or, at least, financial difficulty in furnishing such plant extensions at their own expense. So far as such are concerned, the Navy Department has, therefore, entered into various interesting arrangements.

If the plant extension or equipment desired by the government is of a sort likely to be necessary for the shipbuilder's use in the ordinary conduct of his business in ordinary times, then the Navy Department pays the shipbuilder, as fast as he makes the expenditure, *not to exceed fifty per cent* of the cost. This class of allowances is known as Special Rentals "A."

Five important points are to be noted in this Special Rentals "A" class. *First,* no depreciation on this class is allowed the shipbuilder, the special rentals rate being in lieu of all depreciation. *Second,* owing to the requirements of the laws governing government appropriations, the value of such special rentals is recorded as a part of the cost of the vessels; for example: if the shipbuilder builds an extension to his foundry at $100,000, the government may decide that only twenty per cent of that amount is due to the government's specific requirements; hence, the shipbuilder must pay $80,000 from his own funds and the government will pay him $20,000 in addition, thus making up the $100,000. Therefore, if there are twenty vessels of equal value building at the shipyard, the cost of each vessel will be increased by $1000. *Third,* at the expiration of the contract, the government reconsiders its rate of allowance, and, if equity demand, pays the shipbuilder more or less of the special rentals value, or "stands pat" in the matter. *Fourth,* the title to this sort of plant extension becomes vested in the shipbuilder, and not in the government. The *fifth* point to be noted under the head of Special Rentals "A" is that *no profit* is allowed the shipbuilder upon expenditures made under this head.

If the plant extension or equipment desired by the government is of a sort *not* likely to be necessary for the shipbuilder's use in ordinary times, then the Navy Department pays the shipbuilder, as fast as he makes the expenditure, the full amount of such expenditures. This class of allowances is known as Special Rentals "B."

Four points are to be noted in regard to Special Rentals " B ": *First,* no depreciation is allowed. *Second,* the value of such rentals is carried *in toto* into the costs of the vessels concerned. *Third,* at the expiration of the contract, the government takes title to the property, but the government gives the shipbuilder the option of acquiring title to the property at an agreed-upon price. If the shipbuilder does not offer a price satisfactory to the government, the property remains the property of the government. *Fourth,* no profit is allowed the shipbuilder upon expenditures under Special Rentals " B."

Under the act of October 6, 1917, additional plant facilities were authorized. These are of the general nature of Special Rentals " B," *i. e.,* their full value is payable by the government to the shipbuilder. However, two important differences are to be noted. *First,* under no circumstances is the value of such plant facilities charged as part of vessels. *Second,* the title to property of this nature vests in the government.

Recapitulating, then, this part of the Navy Department's arrangements to finance the shipbuilder, we find that plant extensions are financed thus: *First*—Special Rentals " A "—a fifty per cent allowance, or less, to the shipbuilder, of the value of the property, the title to the property vesting forthwith in the shipbuilder; *second*—Special Rentals " B "—a one hundred per cent allowance to the shipbuilder, the title to the property vesting in the government, but the shipbuilder having the option of purchase from the government; *third*—Plant Facilities under act of October 6, 1917—a one hundred per cent allowance to the shipbuilder, but the title to the property vesting definitively in the government.

XII

Bills covering reimbursement by the government to the shipbuilder for expenditures made by him for material, labor, indirect expense, and to cover his profit, are made monthly. Such bills are made up at the shipyard, certified to by the local Cost Inspection Board, then forwarded to the Compensation Board at Washington for review. The board, if satisfied with the bills, then recommends to the Secretary of the Navy that they be paid. After receiving the signature of the Secretary of the Navy and of the chiefs of the Bureaus of Steam Engineering and Construc-

tion and Repair, they are sent for payment to the disbursing officer of the Cost Inspection Board concerned.

It is evident that if payment were made to the shipbuilder only on his monthly bills, he would always have large amounts of money due him from the government, and, hence, would have his available supply of liquid capital much "tied-up" at any given time. To obviate this difficulty—to pay the shipbuilder with the utmost promptness—preliminary payments are authorized to be made on the spot. The shipbuilder can present a material invoice or a labor roll to the local cost inspector, certify that he has actually made the expenditures, and receive reimbursement forthwith from the disbursing officer detailed by the Bureau of Supplies and Accounts for duty with the local Cost Inspection Board. The shipbuilder is actually paid large sums almost every day within four or five hours after he presents his bill, if he so desires.

The next step authorized by the Navy Department to finance the shipbuilder was to make reimbursements to him for progress payments made by the shipbuilder to a sub-contractor. Warrant of law for the making of partial payments had been granted by the act of March 4, 1911, but such warrant had not been utilized to its full extent. Under the cost-plus contracts, however, this law has come to a wide range of usefulness. For example: five boilers are ordered by shipbuilder, A, from sub-contractor, B. When one boiler is finished but not yet delivered, a navy representative certifies to the local Cost Inspection Board that the boiler appears to be satisfactory. Payment is thereupon immediately made by A to B for the one boiler, even although it may remain undelivered indefinitely, and reimbursement in the proper sum is made by the navy to A.

The next method of assisting in financing the shipbuilder was authorized by a recent act of congress—Urgent Deficiency Act of October 6, 1917. Under the power of this law, the Navy Department has authority to advance to contractors any amounts up to thirty per cent of the value of the contract. Thus, if the shipbuilder makes a contract with a boiler manufacturer in a total amount of $90,000, the shipbuilder can advance to the boiler manufacturer the sum of $27,000, and the Navy Department will immediately reimburse the shipbuilder the $27,000. However, in order that this privilege may not be abused, the prior authority of the department is necessary for each specific sub-contractor.

Also, the sub-contractor is usually required to furnish sufficient security.

Finally, under the act of October 6, 1917, already referred to, the department has authority to make advances to the amount of thirty per cent of the value of the contracts made with the shipbuilders. Thus, if a shipbuilder had a contract for building one hundred ships at $1,000,000 apiece, or $100,000,000, the department could advance $30,000,000 on such ships. In no case, however, although it has advanced several million dollars to the respective shipbuilders, has the department found it necessary to advance even half of thirty per cent.

XIII

In the early autumn of 1917, an interesting development of the "cost-plus" idea took place. The act of October 6, 1917, made available a considerable sum of money for the construction of additional vessels. It was decided that these vessels should be built on a cost-plus-fixed-profit basis, with a bonus privilege. As intimated in the earlier part of these remarks, where the recommendations of the Inter-Departmental Conference were referred to, a cost-plus-fixed-profit arrangement, supported by a bonus-or-penalty-clause, is the best of the possible forms of cost-plus contracts.

In regard to cost-plus-ten-per-cent-profit contracts, there was once current a rather harsh saying: "The more the contractor spends, the more he gets." Owing to competent cost-inspection, this saying has never been meant to refer to navy work, but has been applied in other directions only. It means, however, that the higher the value of the contractor's costs, the greater the sum of money paid to him as profit, since, by the contractual terms, he must be paid as profit ten per cent of his costs. In the cost-plus-fixed-profit contracts, quite a different result ensues. The more the shipbuilder spends, the less profit he gets. This happy condition arises from the bonus privilege referred to.

A concrete example, based on the existing form of cost-plus-fixed-profit contract, will make this point clear. The Navy Department and the shipbuilder agree upon the estimated cost of a vessel—say $1,200,000. Upon this, the Navy Department agrees to pay the shipbuilder a fixed profit—say $120,000. If, however,

it is found, upon completion of the contract, that the vessel has actually cost only $1,000,000, then the shipbuilder receives one-half of the "savings," in addition to his fixed profit. In this example, then, the "saving" below the estimated cost—that is, the difference between $1,200,000, and $1,000,000—being $200,000, the shipbuilder receives one-half of the $200,000, or $100,000, this being in addition to his fixed profit of $120,000. Hence, his total profit on the vessel will be $220,000. It will be seen that, by this kind of contract, the shipbuilder is keenly stimulated to economy in production, quite unlike the cost-plus-ten-per-cent-profit contracts. Thus, the cost-plus-fixed-profit-with-bonus contracts may be expressed in a formula: "the less the shipbuilder spends, the more he gets."

Of course, it would be a still more economical arrangement if a penalty feature were embodied in the present contracts, that is, if the vessel exceeded the estimated costs, the shipbuilder's profits should be cut down by one-half the overrun. This would be a move toward an ideal contract. However, the country does not yet seem to have achieved a state of mind to make this ideal form feasible.

It is a clear indication of the great progress in mutual understanding made possible by the stress of war that, in the relatively short period from April, 1917, to October, 1917, the shipbuilders were willing to shift from the original all-inclusive cost-plus-ten-per-cent-profit contracts to the present vastly more economical cost-plus-fixed-profit-with-bonus-for-savings contracts. They have come to a fuller realization than ever before that they are just as much a part of government as are those of us whose particular duty it happens to be to administer the people's affairs and to see that the laws of the people are carried out. If business men act for the government they act for themselves. If government is ruined by reckless expenditures, business men are ruined. The consequences of defeat in this war would be as hideous to business men as to government. The interests of one are the interests of the other. They cannot be separated. They are the *same* interests. I venture to think that the work of cost inspection, almost as much as any other one thing arising out of this war, has enabled the business world to acknowledge—let us hope forever!—these inexorable truths.

XIV

The savings to the government effected by cost inspection have been very great. Only the merest glance can be given to them here. Amounts saved at the respective "old-line" shipyards, by the correction of actual errors, run from $10,000 to $100,000 each month. While the actual number of shipyards under the cognizance of the Compensation Board cannot be named here, yet the fact may be accepted that the direct savings thus made already aggregate several hundred thousand dollars.

The prevention of the accumulation of improper costs, made possible by the rigorous scrutiny given the shipbuilders' records by the local Cost Inspection Boards, has resulted in economies almost incalculable.

In addition to keeping down costs in the manner above indicated, the Compensation Board has been able to make savings of great sums by negotiations conducted direct from its own office. Lower prices for material than prices first offered have often been secured on large items. In more than one case, as much as a million dollars has been struck off from the price of a single class of equipment.

Various decisions made by the Navy Department, after consideration of recommendations presented by the Compensation Board, have attracted great attention throughout the country. Among these may be mentioned a ruling that bonuses paid by the shipbuilders to officials of their companies cannot be accepted as charges against naval vessels. Of even wider application, is the ruling that no part of federal taxes—income taxes, excess profit taxes, munitions taxes, corporation taxes—paid by the shipbuilders can be reimbursed to them by the navy. Such rulings as these have saved the government very great sums of money, and have prevented inflations of a sort whose deteriorative influences on our national economy might have been almost illimitable.

The time is not suitable for giving more details of the great success of cost inspection. An account of notable results may be permissible in the future. But that the Navy Department's policy has been amply justified in the securing of good-will on the part of shipbuilders and on the part of their employees, to the end that expeditious construction of vessels has been effected, let the commanders of our constantly augmented fleets testify.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME NOTES ON TRAINING MEN FOR CLERICAL AND COMMISSARY RATES

By Lieut. Commander K. C. McIntosh, P. C., U. S. Navy

At this time, when every officer in the navy has been busily training and rating men for over a year, it way seem presumption to attempt any dissertation on the subject of schooling methods. Every supply officer, however, has had difficulties in gauging the amount of instruction which men newly transferred to his department have received; and the school orders leave a great deal of latitude in the matter of what method shall be used to carry out the indicated syllabi. The class-room method is in many ships impracticable of application, and is not entirely satisfactory, as it is possible for a man to recite his lesson perfectly and yet be utterly unable to apply it to actual practice. The so-called "striker method" also has drawbacks. Many a man rated in a pay office has made a dismal failure as a captain's writer, and many an engineer's yeoman has been disrated on transfer to the g. s. k. Particularly lacking is a uniformity in the training of storekeepers, some ships considering that the rating is practically synonymous with yeoman, and others rating storekeepers on the strength of their ability as jack-of-the-dust. As for the commissary branch—stewards and cooks are as hard to pick out as a new razor; and officers' servants are like plenty of sugar—old-timers remember seeing them, but have to stop and think just where it was.

The methods hereafter detailed were applied on board U. S. S. *Kansas* during the summer of 1917. That vessel had been assigned a quota of trained men for transfer in March, 1918. As a result of these methods, the *Kansas* quota of yeomen was completed in September, 1917, the quota of cooks had been exceeded by that time, and in addition five commissary stewards had been

rated, besides a few officers' servants. Effort was made to get a line on the subsequent records of these men after transfer, and it is believed that they made good without exception. On subsequent duty in the Transport Force, two *Kansas*-trained men were the nucleus and backbone of the new organization, although the duty was totally different in character from anything they had seen in the fleet.

YEOMEN

As a rule it is hard to tell from a man's previous experience and general appearance whether he is a likely applicant for the rating of yeoman. Special adaptability for other ratings is normally more or less evident in the candidate's bearing, language and former duties. A good or a bad yeoman is the possible product of training of almost any type of man that we find, from the college trained and muscular athlete to a somnolent and almost slovenly man who has never even reached high school. Luckily, however, ability or lack of it in this line will declare itself very early in the course of training and little time is thus wasted on unprofitable material. No candidate should be refused a chance on account of appearance, bad grammar, or poor handwriting, as long as he can make legible figures. On the other hand, the most likable-appearing youngster should not be bothered with, if his deck division officers cannot give him a reputation for willingness.

From the beginning of training, classes should be held not less than twice a week. Study for this school period should be confined to the Bluejacket's Manual until "A to N" has been thoroughly covered; thereafter "Y 1, 2, and 3" may be supplemented by chapters of the regulations. The candidate should be assigned to one of the ship's offices for a week, with special instructions to familiarize himself with the forms there in use, and given all the typing to do which he can handle. At the end of the week, the yeoman in charge of the office furnishes a report, not on the candidate's prowess, but his *ability and desire to learn*. He should then be moved to another office for a further period of a week, then moved again. An unfavorable report by two of his first three yeomen-in-charge should terminate his instruction and chance of rating. When possible, the best results have been found to follow when the first week is spent in the engineer's log-room, the second in the ordnance office, the third in the executive

office, and the final training in the pay office or g. s. k. During this period of office instruction, the candidate is not to be made a messenger-boy, neither is he exactly a striker; in that he is additional to the regular yeoman-and-striker complement of the office, and is given work in that particular line even when the regular office force has cleaned the desk. The main idea is to crowd as much typing and acquaintance with as many blank forms into his first month as possible. If he is temperamentally fitted to become a valuable yeoman, that first month will give him a surprising amount of knowledge in these two lines, and best of all will *show him so clearly what he does not know* that he can practically instruct himself from then on. The second month, he should be permanently stationed as a member of some ship's office force. There will always be room for him—no navigator, ship's writer, first lieutenant or pay officer ever has too many men in his office. At the end of two months, you will have a much better third-class yeoman than can usually be made in six months in any one office in the ship or by the class-room method only; and on transfer, the man will have a far better chance of making good in whatever office he may be placed. The particular job which was found to get greatest results in the second month of training is the commissary-record desk in the pay office. Beside involving the use of a great many forms, it also includes the checking in of stores, preparation of surveys, keeping of stock-sheets, and best of all will plainly and immediately indicate any desire to put off "finishing up the job" until to-morrow. The commissary desk must be clean every night or there is immediate and apparent trouble; and moreover, it is the easiest bookkeeping desk in the ship for the officer in charge to check up quickly and accurately.

STOREKEEPERS

Not every man who applies for training as storekeeper will be found worth attempting to train. There are many exceptions; but as a rule, if there is any promise in him, the candidate should have sufficient physique to shoulder a bag of potatoes without getting red in the face and mental quickness to enable him to get rid of a fairly lengthy example in long division in reasonably short time. These two simple capacity tests will remove an amazing number of otherwise promising applicants. Storekeepers must be husky enough to spend most of their time below-decks without

injury to their health, and should temperamentally be of the so-called "scatterbrain" type—any knowledge of any sort to be a thing they will strive for, and learning any new thing in any line a genuine pleasure. Their knowledge of blank forms need not go much beyond invoices, bills-of-lading, stubs and stock-sheets and cards; but the genuine, born storekeeper is unhappy as long as one article rests in the issue room for which he does not know the name and use. A man who applies for a job as storekeeper with *fresh* paint spots on his clothing, with long hair, or with broken finger-nails, may develop into a good record keeper, but will always require driving to keep his stock well sorted and carded. In training applicants, practically all the stress should be laid on nomenclature and care of stock. Bi-weekly classes in "A to N" should be held, with the Bluejacket's Manual for text-book; and it will usually be found that the embryo storekeeper will beat the prospective yeoman badly at that game. For the first month of training, storekeepers should be successively attached to the gangs of the fireman, electrician, gunner's mate and carpenter assigned to the supply division. Once a week a pile of miscellaneous "small reckonings" should be assembled in the survey-room without labels, and the candidates required to name them, define their use, and the best methods of stowing and preserving them. Make the acquisition of stock-keeping lore a competitive game. Finally, as a small psychological aid to efficiency—provide every storekeeper you have with a chest for his clothing as near his job as possible without actually being in the store-room. If chests are not allowed, try to get him a locker. It is part of the successful storekeeper's temperament to hate slinging a bag as the devil hates holy water. Why, I cannot say, unless it be that it offends his ideas of visible and accessible stowage.

COOKS AND BAKERS

The first thing to find out about a man who asks for a job as galley-striker is "Can he stand it?" Galley decks are normally dry only twice a day—just before first lieutenant's daily inspection and just after shifting watches at one-thirty or thereabout. The air is surcharged with steam at least ten hours a day, and the temperature shifts suddenly and violently. Even a thin cook should be deep-chested and thick-necked; while as a general rule

it requires a muscular and stringy man to stand the heavy lifting and intense heat of the ship's bakery.

The next requirement enters the realm of pure psychology—has the applicant a bad record, and why? If he has been passed from one division to another by irritated division officers, if his record shows many warnings at the mast or even a court or two for "talking back to petty officers," "surliness," "scrubbing clothes in unauthorized places," or "clothes in lucky-bag," take him, Mr. Supply Officer, take him quickly before he adds A. O. L. to his crime sheet and is set ashore with a short ticket. You have your ideal cook-material; for you have found a man with the irrepressible artistic temperament, who will learn in two months to add his condiments accurately by instinct, to abominate a potato-peeling behind the range and to storm at a mess-cook with muddy feet. His progress depends entirely on the supply officer's ability to discover the particular manner of controlling him and to persuade the executive officer that he deserves rating in spite of his red-inked record. As for the former, no definite rule can be formulated. Each cook must be handled and catalogued separately; each one will have his own particular weak spot to be found and used. Eternal vigilance and diplomacy are the price of a smooth-running galley. In the writer's experience was one galley containing two first-class cooks. The junior was the sort who would work himself blind if complimented and "greased" a little. The senior, on the other hand, was the kind who required a periodical calling-down—a normally lazy man who could be irritated into a frenzy of cleanliness and good cooking by a carefully-placed minor criticism, but who would loaf and bask for a week in the warmth of one hearty commendation As cooks will, when of equal rating, these two quarrelled frequently, and together buttonholed the supply officer for "justice." To call down the senior and smooth down the junior while they were together and at the same time uphold the authority of the senior without placing the junior in a second- or third-class position was a job which the Versailles Conference might well have avoided; and the fact that that particular galley continued to go right is one of the proudest plumes in my professional bonnet.

Instruction of cooks and bakers, aside from actual galley striking, should be class-work, preferably lectures by the com-

missary steward, wherein each man is required to keep a recipe-book of a sufficiently legible character to permit examination once a week by the commissary officer; and the daily menu should form the basis of the daily study for a month. In that period, all the normal sea-going dishes will have occurred in some form or other, and the recipe-books may be completed by esoteric entries of roues, meringues, sauces, and so forth. Individual progress is easily noted by the commissary officer. If you come into the galley an hour before a meal and find a candidate of a month's training watching the cook-in-charge work, go immediately to the steward and ask "What's wrong with So-and-so?" If the cook-in-charge, having seen you approach, is found making dabs at the deck with a swab while the neophyte sprinkles salt on the pork-chops or opens the oven to watch the candying "sweet-spuds," your galley striker is making good.

To dilate a bit on the psychological side, if you can manage to have an uptake, no matter how small, turned over to the galley-force for a drying-room, "Provided they keep it clean, chipped and painted," and can obtain permission for them to use the wash-room for scrubbing during the dead hours of night, you will note a distinct reduction in galley quarrels and an increased pride in turning out good meals.

Sometimes a promising cook will suddenly "go wrong" in inexplicable fashion. That is nine times out of ten a case for the supply officer to cure personally. If he gets hold of the man, plainly states wherein he is "falling down," and demands a reason therefor without heat and reserving judgment, the reason is usually forthcoming in the form of a personal hard-luck story which may not have the slightest connection with the ship or with his work. One case in point was that of a man whose wife was very ill and begging him to come home. There was no reason why the man should not have leave; but he had not asked for it, because his record before he entered the galley had been bad, and he was afraid to make the request. "If I'd asked and not got leave, sir, I'd a-gone bugs and jumped ship. So I just didn't ask." Five days' leave and a special money requisition closed that incident, and within a year that particular cook had become the main-stay of the galley and was well on the road toward a steward's rating.

COMMISSARY STEWARDS

Of all ratings aboard ship, this is perhaps the most difficult to fill; and it is unfortunate that as a rule only cooks and bakers aspire to it. The ideal commissary steward should have all the qualities which go to make a successful yeoman, storekeeper and boatswain's mate as well. He must have a yeoman's accuracy, a storekeeper's eye for detail and love of work for result's sake, and a boatswain's mate's ability to get work out of men. More, he should be able to make men work fast and *cheerfully*—his working party should jump to his "Come on, Jack. Let's go!" with as much alacrity as follows the most stentorian "Bear a hand, there! On the run!" The prospective commissary steward should have a record that has been clean for at least six quarters and without any serious entries whatever; and he should never have been a failure in any job he has tackled. His previous duty is of small moment, provided it has been responsible duty and provided he has made good in it. Of six *good* commissary stewards trained and rated during the war by the writer, one was made from yeoman second class and one from gunner's mate first class. A candidate should never be rated until you would feel safe in placing your own mess in his hands—aside from almost certain trouble to other supply officers, you might get him back some day. His training should begin in the class-room, and he should be made to work hard. If he "makes a four" one day, increase his assignment for the next, until you have proved that he can remain unruffled and accurate under pressure of haste. This academic instruction should continue until he can sing the ration forward and backward, not only in terms of ration allowances, but issues for a meal in terms of so many hundred men, estimates for a week or a month and balances on provision requisitions. He should know all commissary forms thoroughly, and be able to keep a clean and accurate stock-book. He should have a fair and orderly knowledge of filing records; and should be made to work out every old provision return you have in your retain files. Don't raise your eyebrows—never let the steward keep *your* provision return; but make him keep *his*. Comparison of the two at the quarter's end will tell you more of your steward than fathoms of examination and talk. He should be able in two minutes to furnish documentary answer to such

however, should be punished, if possible, in the presence of every other negro aboard ship. Unlike white men, the spectators will not "rub it in" to the unfortunate. They will perhaps bet him that "Dey'll nevah git me in dat fix," which is the state of mind most desirable to produce. And finally, never forget that the negro is a past master in the art of insinuation, and will in the most artless fashion try to make you laugh in your most Olympian moments of just wrath, and will deliberately attempt to lay up a store of good favor against an *offence he intends to commit some time in the future.*

But the Golden Rule in training men, is after all, to know each one of them as well as possible, to understand his individual likes, dislikes, strong points and weaknesses. You can easily do this without either undue familiarity or intruding on his privacy. And aside from enormously increased control of your department, you will find that the American bluejacket is a chap well worth knowing and from whom you yourself can learn a great deal.

THE FIVE-MASTED MOTOR SCHOONER "GENERAL PERSHING." SALVAGED BY THE "CINCINNATI."

A MODERN STEEL TANKER OF THE TYPE OF THE "EDWARD L. DOHENY."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

YOUNG AMERICA

By Commander Stanford E. Moses, U. S. Navy

The novelty in the narrative which follows centers chiefly in the youth and spirit of the men who did the work.

In one week they successfully floated two large ships which had gone ashore on shoals or reefs in the Straits of Florida.

This would have been nothing for experienced wreckers to do, with proper salvage equipment, but it was creditable seamanship for young men and boys, recruited largely from the mountains and prairies; many of them having seen salt water this year for the first time in their lives.

In giving help, as so often happens, they unconsciously received it in return. The week was one of practical instruction in the rudiments of seamanship. Handling ground tackle, running lines; lowering, hoisting and handling boats, and discharging cargo, became every-day, and every-night affairs. It was valuable training. Salvage operations may be expected to play an increasing part in the navy's work.

The rapidly increasing number of ships in the navy and mercantile marine should naturally increase the number of groundings, collisions and other accidents.

The rapid increase in the number of ships involves a corresponding expansion in the personnel, to man the fleets.

These conditions necessarily lower for a time the average skill of operating and handling ships, because of the comparative inexperience of many of the officers and crews.

Quick construction and limited periods available for inspection, test and trial tend to make the new ships less staunch and less reliable, on the average, than the peace-times ships of more deliberate construction and employment.

In European waters the primary causes of increased salvage work have been the unrestricted submarine campaign and the casualties of battle.

These causes, especially submarine attacks, may be expected to increase the scope of salvage work in the western Atlantic, the Caribbean, and Gulf of Mexico.

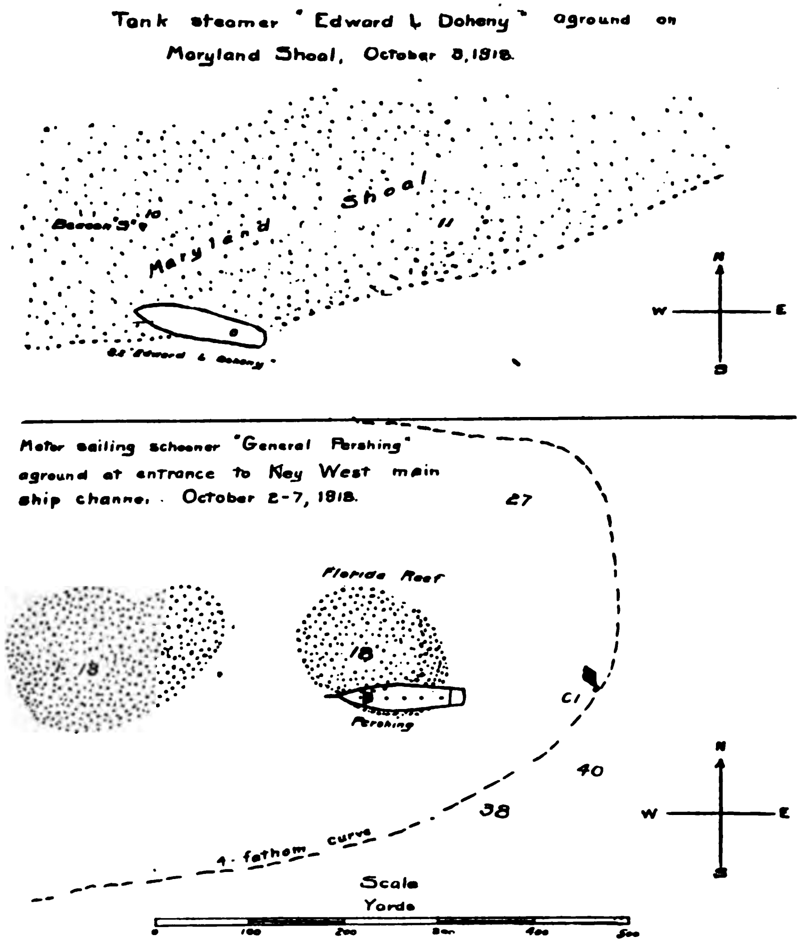


DIAGRAM I.

Naval vessels are not as a rule well fitted for towing and salvage operations, and their wrecking equipment, as compared with a modern salvage outfit, is primitive and ineffective.

But forethought will enable the tools available to be used more effectively, and this account of a week of salvage work may give

those who read it some ideas or suggestions of practical value in similar situations.

During the first week of October, 1918, while in command of the U. S. S. *Cincinnati*, I was placed in charge of salvage operations which resulted in successfully floating the five-masted motor schooner *General Pershing*, and the large tank steamer *Edward L. Doheny.*

Both ships were floated practically unharmed.

The *Cincinnati* was assisted by the *Albatross* and by the lighthouse tender *Ivy*.

The small tug *Peoria* also rendered some assistance, and submarine chasers *320, 189,* and *335* ran lines and handled lighters and men. The *Pershing* went aground October 2, and the *Doheny* October 3, within fifteen miles of each other; the *Pershing* on Florida Reef, 200 yards west of the entrance to Key West main ship channel; and the *Doheny* on Maryland Shoal, 50 feet south of the beacon.

Maryland Shoal is three and a half miles to the westward of American Shoal light, in the Florida Straits.

Both ships were aground on soft coral or sandy bottom, and heading west. The condition of weather, wind and tide and current were almost identical.

There was deep water on the port side, astern, and on both quarters of the *Pershing;* but only on the port side and port quarter of the *Doheny*. By deep water is meant sufficient depth to float the grounded ships and the ships engaged in salvaging them.

It is fortunate that these conditions were not reversed, because it was necessary to work on the starboard quarter of the *Pershing;* but not of the *Doheny*.

The first diagram shows the positions of the two ships when aground.

As the *Doheny* was a long modern steel tanker, aground forward and afloat astern, the task of floating her was quickly and simply performed when the proper time arrived, by pumping out forward and flooding the after tanks during the towing operations.

The *General Pershing* presented a much more difficult problem because she was drawing almost the same water, 20 feet, forward and aft, and her trim could not be readily changed.

In grounding she had driven, bows on, across one hummock and upon a second one, resting on both. The diver's sketch showing the result of his examination, suggested a ship's model resting securely on two saddles.

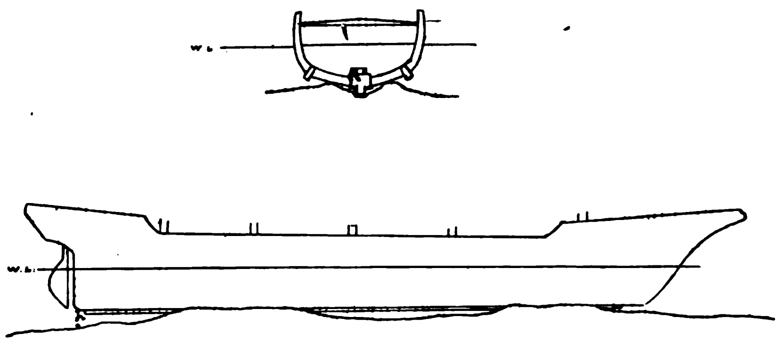


DIAGRAM 2.—Motor Schooner *General Pershing,* aground on Florida Reef. Drawing made from sketch submitted by diver, Chief Gunner's Mate Turpin, of the *Marblehead.*

The pocket shown in the sketch on either side of the vertical keel was probably caused by a nearly successful attempt to tow the stern off to port into deep water.

With two kedges out and three ships towing off the port quarter the *Pershing's* stern began to swing very slowly to port. Degree by degree the stern swung out two points, and the tidal current, increasing in velocity, set against the starboard quarter and added to the forces swinging the stern toward deep water.

Unfortunately the increasing tidal current also set one of the towing ships down upon the other two, which were towing in tandem, and she let go and ran clear.

With three ships towing, the forces were almost balanced. The sudden release of one of the tow lines allowed the *Pershing's* stern to swing back on the shoal, and her momentum ripped out the chock through which the tandem tow line was led, and carried away the towing bitts on the *Pershing.*

The ship swung back with sufficient force to stick. She could never again be swung in azimuth, but five days later was finally pulled directly astern and floated.

It is a part of this story to note that when the tandem tow line carried away on the *Pershing* it created considerable havoc.

Rigging and wreckage and splinters were flying. All hands on the *Pershing* ran to places of safety, except one man; or rather, one boy; a nineteen-year-old signalman named Velasco, who stood where he was—and he was in a very dangerous place—and signaled to stop towing. It was 1.00 p. m., October 2, when orders were received to proceed with the *Cincinnati* and *Albatross* to the rescue of the schooner aground near the harbor entrance.

The *Albatross* was then underway. The *Cincinnati* was underway forty minutes later, but stopped to get a wire towing bridle from another ship and arrived on the scene at 3.00 p. m.

The *Albatross* had already run a line to the *Pershing's* stern and hauled until the line parted; but without result.

The light-house tender *Ivy* came up, and rendered valuable assistance. A conference was held on the *Pershing*, attended by the commanding officers of all ships present.

Ensign Quinby of the *Cincinnati*, also attended this conference. He remained on the *Pershing* as wrecking master during almost continuous night and day work during the week that followed, and did excellent work, calling forth particular expressions of appreciation from the master of the *Pershing* in a letter of thanks addressed to the officers and crew of the *Cincinnati*.

Ensign Quinby—please remember the title of this narrative—was enrolled as a seaman second class, U. S. Naval Reserve Force, more than a year ago; but he had no seafaring experience before joining this ship, seven months ago.

At the conference on the *Pershing* it was planned to lay out kedges astern to keep the ship from working further on the shoal.

The tide had just begun to rise and the captain of the *Ivy*, with local knowledge, believed it to be advisable to begin towing at once, in the hope of hauling the ship off at that night's high tide.

This plan was tried, but failed.

Early the next morning, October 3, the work was begun of laying out kedges astern and on the port quarter of the *Pershing*.

The *Cincinnati's* sheet anchor was used as a stern kedge. The sheet chain was unshackled at 30 fathoms and the eye of a wire hawser was shackled to the end of the chain. The wire, which had been passed outside of everything from aft, was bighted down on the poop and stoppered clear for running. The *Cincinnati* then worked into position astern of the *Pershing*, let go her

sheet anchor, and sent the end of the wire to the starboard quarter of the *Pershing*. The sheet chain was buoyed with new five-inch line, with ample drift, for use in recovering the anchor.

That morning, October 3, another order was received, for the *Cincinnati* or *Albatross*, or both, to proceed immediately to the rescue of the tank steamer *Edward L. Doheny*, aground on Maryland Shoal, three and a half miles to the westward of American Shoal light.

The *Albatross* stood to the eastward immediately. The *Cincinnati* finished laying out her sheet anchor and then followed the *Albatross*.

Ensign Quinby was left, with the *Ivy*, to continue the work of laying out the kedges and heaving them down hard as the tide fell. Lighters had been sent for, as it was evident that the *Pershing* was hard and fast aground. The work of lightering the cargo was begun. The effect of this work will be referred to later.

Upon arriving at Maryland Shoal it was found that the *Doheny* had her bow high up on the reef, upon which she had struck at 3.00 a. m., almost carrying away the beacon.

The *Albatross* and *Peoria* were lying off preparing to tow in tandem. The *Albatross* had already attempted to tow the *Doheny* off, but had been set into dangerously shoal water.

The *Edward L. Doheny* is a modern steel tanker 415 feet long. She was in ballast, and went on the reef bows on, heading to the westward.

A conference was held on board the *Doheny*.

Ensign Johnston of the *Cincinnati*, with a signalman, was left on board the *Doheny* as wrecking master.

Until the United States entered the war Ensign Johnston's seafaring experience had been confined to tennis courts, where he rode the crest of the wave, and won the championship of the world.

But to return to the *Doheny*. When the ship struck the reef in the night, and began to pound, the captain, being unable to back off, wisely flooded tanks until she rested easily, and then waited for daylight and assistance.

The ship's stern, fortunately, was afloat, and her propeller clear.

With a kedge astern and ships towing, the *Doheny* pumped out ballast forward and flooded aft.

The *Albatross* and *Peoria* having parted a tandem tow line, the *Cincinnati* anchored close to the reef on the *Doheny's* port quarter, veered down and ran a wire hawser to her starboard quarter.

When all was in readiness the *Doheny* backed full speed, the *Cincinnati* hove in on her chain and steamed ahead, and the *Doheny* floated clear, at about 4.00 p. m., October 3.

The *Cincinnati* got the wire hawser on board and all ships returned toward Key West, in time to resume work on the *Pershing* without losing a tide.

It may be well to explain more clearly the situation on the *Pershing*. She is a large wooden five-masted schooner, with twin auxiliary engines. But one engine was out of commission.

The ship had recently run through a hurricane and had lost several of her spars. Wire rigging falling over the side had fouled her port propeller. She was loaded with lumber, long heavy timbers. The deck load was covered with oil, which made the task of lightering the cargo not only dirty work, but also slow and difficult. There was practically no water ballast or other easily shifted cargo, which might have lifted her bow or stern clear of the shoal. For five days and nights kedging and towing continued. Large working parties of seamen from the Naval Training Station and seamen and marines from the *Cincinnati*, assisted the small and inexperienced crew of the *Pershing* in discharging the heavy timbers and loading them on lighters.

It might have discouraged the working parties to know that the result of their arduous labors was to decrease the draft of the *Pershing* less than two inches a day. But they did not realize it.

It was necessary to continue the work of lightering cargo because the ship lay in the coral sand like a great log, and there was doubt as to the ability of the available vessels and gear to haul her off the shoal.

A twelve-inch hawser parted under heavy strain, and this for a time seemed the last resource.

But a large new wire hawser was found in store, and on the night of October 7, the *Cincinnati* and *Ivy* were anchored in position and ready for towing as the tide neared the flood.

The *Cincinnati* had shortened in on the twelve-inch hawser led to the *Pershing's* port quarter, let go both anchors and veered to a long scope of chain.

The *Ivy* towed off the *Pershing's* starboard quarter.

The *Cincinnati* hove in on both anchors until there was a strain on the chain, then steamed ahead slowly on one engine, then on both engines, gradually increasing the speed of the engines and heaving around on the anchor engine as the hawser straightened out.

At 9.15 p. m., October 7, shortly before the top of high water, the *Pershing* slid about half her length astern. This probably brought her bow upon the eastern shoal, leaving all the rest of the ship afloat. Another light pull brought her entirely afloat.

The *Ivy* slipped and got clear and anchored.

The *Cincinnati* held on and towed the *Pershing* well clear, when the *Pershing* cut the twelve-inch hawser and anchored. The men on deck cheered.

The word was passed to the engine room, and three more cheers came up through the fire room ventilators.

It had been all a part of the day's work, with an element of novelty to spice it.

The *Cincinnati* got the twelve-inch hawser on board and anchored for the night.

The next morning the *Ivy* and *Peoria* towed the *Pershing* into port, and the *Cincinnati* proceeded on other duty.

This was the work of youth and inexperience. Spirit and versatile intelligence carried it through.

Men who began with ten thumbs ended the week with a better proportion of fingers.

A number of the petty officers taking active direction of the work, boatswain's mates and coxswains, were less than twenty years of age, with less than a year of sea service to their credit.

The executive officer of the ship was absent.

Lieutenant F. B. Stump, U. S. N., navigator and acting executive officer, the man who had full charge of the details of the work, is not yet twenty-four years old. He was graduated from the Naval Academy eighteen months ago. His direction of the work was in no sense nominal or perfunctory.

It was necessary for the captain to remain on the bridge during the many hours of towing.

The youthful executive officer, with young and inexperienced officers and petty officers, was in full charge aft.

He had to make many trips between the ships and arrange for working parties, food, relief, and make all preparations for tow-

ing, running lines, repairing damages, and carrying on the ship's routine.

So much for young America.

The chief boatswain's mate was a tower of strength, as all chief boatswain's mates should be at such a time; but as youth goes in these days he is a veteran. He must be thirty years old, though he doesn't look it.

From these experiences, and from earlier work of this kind which has fallen to my lot, the following suggestions are offered to any who may need them.

(a) When going to the rescue of a stranded vessel, rig ship for towing and get up gear that will probably be needed.

(b) This gear includes heaving lines, light lines for running hawsers, heavy hawsers, fenders and shackles, shackling tools, small jiggers and heavy deck tackles.

(c) See that a good life boat's crew is ready.

(d) Provide a lead line marked in feet, and detail an officer or competent man to sound and make a sketch and record of soundings around the stranded vessel, and of the water in which the towing ships must work.

(e) Look up the state of the tide, the rise and fall, times of high and low water, prevailing set and drift, and the variation in the tide. This variation in the tidal rise may sometimes be of great importance.

(f) See that sheet anchor and chain, and kedges are free, and bitter ends of cables ready for slipping.

(g) Close water-tight compartments wherever practicable.

(h) Pick an officer for wrecking master, and a signalman to accompany him.

(i) Arrange simple signals. Give one copy of signals to wrecking master and post one copy on bridge. These signals should include, for night and day; 1. "moving," 2. "stop," 3. "haul," 4. "all clear," 5. "not clear," 6. "cut," 7. "let go."

Semaphore, by day, or blinker, at night may be used for all of these signals except 1. "Moving," and 2. "Stop." Whistle signals, day or night, or flags by day and lights at night, should be arranged for reporting any movement of the stranded ship and for stopping the tow instantly.

(j) Put over, mark and tend a heavy drift lead on the stranded ship, and on each ship in position for towing. At night a quick

leadsman may inform the bridge that the ship has started ahead before report can come from aft that the line has parted.

If the towing ship has out a long scope of chain and stops her engines promptly after a tow line parts, or the stranded ship suddenly floats, then she will not gather headway enough to hurt anything.

But she should not have out enough chain to extend back to her own propellers when the chain tends aft. A broken line may prevent the use of the engines.

(k) All should be in readiness to heave in the chain, or else to veer it and slip if necessary, to avoid a collision.

(l) As a rule the stranded vessel will have her anchors down, to lighten the bow, and perhaps for kedging. And there is little danger of the vessel colliding with the towing ship.

In the case of the *Doheny,* however, she had out only a small kedge astern. She picked up this kedge too quickly, fearing it would foul her propeller.

As a matter of fact, picking up this kedge too soon almost caused serious trouble. It allowed the *Doheny's* stern to drift across the wire towing hawser; but the *Cincinnati's* whale boat got under the *Doheny's* counter and cleared the wire before it fouled the screw. In doing the job over again I would make the *Doheny* let go a bower anchor to check her sternboard when afloat.

Perhaps the most interesting minor detail in connection with the salvaging of the *Pershing* was as follows:

The *Cincinnati* shackled a wire hawser to her towing bridle and sent a hauling line from the end across to the *Pershing.*

In hauling the wire across it caught on a coral head on the bottom, and stuck. Steam winches and men could not move it, and the experiment was tried of underrunning the wire hawser by forcing the bow of a motor sailing launch along under the wire.

The coxswain of the motor sailer, a boy of nineteen, was ordered to stop the engine in order that he might clearly hear his instructions. With the engine stopped the boat was moved under the wire, and the crew began to haul it ahead. The bow of the boat wedged itself under the wire, and as the bow man walked the hawser aft the boat moved easily ahead, lifting the wire hawser from the bottom as it forged ahead.

Some component of the tidal current must have set the boat along the wire. Without starting the engine, with only the

pressure of a bight of the hawser behind it, the boat ferried itself quickly across from the *Cincinnati* to the *Pershing* in about two minutes, and the line was clear.

Captain L. H. Chandler, in the May number of the NAVAL INSTITUTE PROCEEDINGS, explains a towing trick learned from Chapman & Merrit, wreckers; the use of a spring on the tow-line to hold the towing vessel up against the set of wind or tide.

Within the past week I have seen a towing vessel forced to slip and run in order to save herself, when a spring from her bow to the tow-line would have held her safely in position.

Captain Chandler also quotes an experienced wrecker's axiom to the effect that beyond a certain point it is of little use to add to the strain on towing hawsers and kedges.

By very gradual increase in the strain on the towing gear a close approximation can be made to the maximum strain that it is advisable to put on the hawser. It may be advisable to break the weakest link in the gear in order to be sure. After knowing about what towing strain may be safely taken, it may be advisable to try towing at various angles with the keel of the stranded ship. The facilities for flooding, pumping, and shifting cargo should be carefully considered. They may solve the problem.

If a good diver is available it may be well to send him down to examine and report the underwater conditions.

The amateur wrecker undertaking salvage operations on an extended scale should prepare himself for many failures and disappointments; it is a job for Job, requiring infinite patience under adversity. On the other hand, it is a task where patience yields an almost sure reward.

In wrecking, the importance of the tidal rise and fall may vary greatly.

In the salvage of a ship like the *Doheny*, with stern in deep water and ability to alter trim several feet quickly by shifting ballast, a small tidal rise may sometimes be neglected.

In salvaging the *General Pershing* the tide was the controlling factor. The best speed of discharging the cargo lightened the ship only about two inches a day.

The range of the tide was approximately twenty inches, which was equivalent to a lift of a thousand tons.

It is well to remember that,

> "There is a tide in the affairs of men,
> Which, taken at the flood, leads on to fortune."

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

RESILVERING SEXTANT MIRRORS

By Lieut. Commander Robert T. Young, U. S. Navy

At present when ships are making long sea voyages, frequently the navigator will find that his sextant mirrors are going bad and no spares available. He is also apt to find his sextant mirrors in such condition that although the sun can be handled, great difficulty is encountered with stars. If such is found, the mirrors can be very successfully resilvered with the facilities on board ship.

Frequently I have asked navigators and officers who have finished their navigator's cruise, if they ever resilvered their mirrors; invariably the answer was that they had tried it, but could not make it work.

The following system was used on a surveying expedition to the Sandwich Islands of which the writer was a member, and was found to be very successful; in fact, the system we used entirely to keep the boating parties supplied with mirrors.

Preparatory

(a) Get some tin-foil—that from the average package of cigarettes is entirely satisfactory.

(b) Obtain a small bottle of ether-alcohol from the doctor—this is used to thoroughly clean the glass.

(c) Get a few drops of mercury—should no other be available, a few drops from the artificial horizon will not be missed.

(d) Obtain some clear shellac—the gummy sediment which collects in the base of receptacle is better. If possible and near a navy yard, send the chief quartermaster over to the yard and borrow a small bottle of the substance used at the yard for that purpose.

Operation

(a) Carefully unroll the wrapping of the cigarettes so as not to crumble the tin-foil. Cut out a piece about twice the size of that which will be required for the actual backing. Place this on a pad of paper, examine and see which side will be the better

for the backing. Your eye will quickly note which will be the better. Decide; place it on a pad and flatten by placing a piece of paper on top, and apply light pressure.

(b) Thoroughly clean the glass with ether-alcohol and absorbent cotton.

(c) Place a few drops of mercury on a clean blotter and thus remove any dirt.

(d) Place a drop of mercury on the part of the tin-foil which will not be used for actual backing. It will form like a blister. Raise the pad and enlarge blister by an inclined circular motion. Add more drops of mercury as necessary until the blister has extended over the entire tin-foil. Put the pad down on the desk. Take the sextant glass and gently slide over the mercury. Examine and see if clear of flaws. Then remove glass by sliding off and reclean. Some sediment will probably be found on the surface of the mercury. Again gently slide the glass over the mercury to the correct position, and if clear of flaws, turn up the outboard edges, place the pad in an inclined position to allow the excessive mercury to drain off and let backing set. At least twenty-four hours should be allowed.

(e) Collect the excessive mercury and put in bottle. It is essential that the part of the tin-foil where the mercury was first dropped on should not be used as the actual backing. For some reason this spot will crumble up and spoil the backing.

(f) When tin-foil has set, remove the edge and apply backing. In applying do not use a brush or anything that rubs. It will tear the tin-foil. Apply as you did the mercury to the tin-foil. Put on one drop and work it over the tin-foil by an inclined circular motion, until entirely covered. Be careful to just cover the observing edge, but thoroughly cover all the other edges. Then let backing set and dry.

It is well to practice first with a piece of glass about the size of an index glass, but watch the sharp edges. They are apt to tear the tin-foil. After a little practice you will be able to make perfectly satisfactory mirrors—so will your chief quartermaster.

Although the above will be found to be perfectly satisfactory, it is essential that the navigator should not allow his sextant to be unduly exposed, or his mirrors to get in unsatisfactory condition, but if they should and time be available, the above will be found to produce excellent results.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Prize Essay Contest, 1919

The Board of Control announces the following awards in the Prize Essay Contest, 1919:

First Honorable Mention to Captain Reginald R. Belknap, U. S. Navy. Subject, "Military Character."

Second Honorable Mention to Lieut. Commander Beirne Saunders Bullard, C. C., U. S. Navy. Subject, "Some Reflections on the Three Factors of Battleship Design."

No Prize Essay has been awarded for the year 1919.

Book Announcements

Elementary Steam Engineering by C. M. Reed has been published by the Institute and is ready for sale; for table of contents see book list. The Institute will publish the "North Sea Barrage," a short photographic history of the U. S. Mine Planters' operations in the North Sea. The book will be ready about April 15, 1919, and sell for $3.00 per copy. The edition will be limited and the Institute will be glad to receive orders in advance.

Dues

The annual dues ($2.50) for the year 1919 are now payable.

Membership

Life, regular and associate membership, 5728.
Resignations: 10.
Deaths:
Rear Admiral S. W. Very, U. S. N., Ret.
Lieutenant Commander Merritt Hodson, U. S. N.
Lieutenant C. E. Lewis, U. S. N.
Lieutenant W. H. A. Pike, U. S. N.
Mr. M. R. Tipton.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS *are to be sent, and thus insure their receipt. This precaution is now of particular importance as notices of changes of stations are not now available for use of the Institute's staff.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 10th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations

Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS (March, 1913, June, 1913, September, 1913, January-February, 1914, January-February, 1915, and November-December, 1916, January, 1918) are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 25 cents per copy.

ANNAPOLIS, MD., January 15, 1919.

INFORMATION INDEX

UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MD.

REPORT OF AUDIT FOR THE YEAR ENDED DECEMBER 31, 1918

BALTIMORE, MARYLAND, January 14, 1919.

TO THE OFFICERS AND MEMBERS OF THE UNITED STATES NAVAL INSTITUTE,
ANNAPOLIS, MARYLAND.

Gentlemen.—We have audited the books of the *United States Naval Institute, Annapolis, Maryland,* for the year ended December 31, 1918, and submit herewith a certificate, one page of comments and the following exhibits and schedules:

Exhibit A.—Balance sheet as of December 31, 1918.

Schedule No. 1.—Statement of cash receipts and disbursements for the year ended December 31, 1918.
Schedule No. 2.—Investments.
Schedule No. 3.—Accounts receivable.
Schedule No. 4.—Accounts payable.
Schedule No. 5.—Advanced payments all as of December 31, 1918.
Schedule No. 6.—Statement of income and expense for the year ended December 31, 1918.

Respectfully,
BLACK AND COMPANY,
Certified Public Accountants,
By WILMER BLACK, C. P. A.
(*Member American Institute of Accountants.*)

UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MARYLAND

CERTIFICATE

We have audited the books of the *United States Naval Institute, Annapolis, Maryland,* for the year ended *December 31, 1918,* and

We hereby certify that the accompanying *balance sheet* and *statement* of *income* and *expenses* are correct and in our opinion, subject to the attached comments, clearly set forth the true financial condition as of *December 31, 1918,* and result of operations for the year ended *December 31, 1918,* respectively, as disclosed by the books of account.

BLACK AND COMPANY,
Certified Public Accountants,
By WILMER BLACK, C. P. A.
(*Member American Institute of Accountants.*)

Baltimore, Maryland, January 14, 1919.

UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MARYLAND

COMMENTS ON THE AUDIT OF THE BOOKS FOR THE YEAR ENDED DECEMBER, 31, 1918

Exhibit A, Schedule No. 6, shows the Cost of Publications sold. The overhead this year is $11,852.64 and 5.45 per cent should be added to the cost to include these items.

Notwithstanding a marked reduction in the value of the inventory and a charging off such an amount as will bring the value of investments (bonds) on the book at the market value the Net Profits for the year is $53,121.35.

There has also been charged into this year's expenses, cost of books, etc., sold during the year ended December 31, 1917, to the amount of $2,359.81, which makes the Net Profit for this year just that much less.

Heretofore all receipts from Dues, Advertisements and Subscriptions have been taken up as an earning for the year in which they were received. This year, however, there has been taken up as an earning only those items that have actually been earned during the year and all items paid in advance have been carried as a payment in advance, for details see Exhibit A, Schedule No. 5.

Our examination has been very carefully made and no discrepancies or inaccuracies were disclosed. The records, books, accounts, etc., were found to be in good condition and worthy of commendation.

EXHIBIT A

BALANCE SHEET, DECEMBER 31, 1918

ASSETS

Current Assets.		
Cash (in bank), Schedule No. 1	$44,017.33	
Investments, Schedule No. 2	65,805.00	
Accounts receivable, Schedule No. 3	74,257.02	
Inventory	15,159.96	
Prepaid royalties	1,193.83	
Total Current Assets		$200,433.14
Balance	$157,078.55	
Furniture and fixtures	100.00	
		$157,178.55

LIABILITIES

Current Liabilities.		
Accounts payable, Schedule No. 4	$41,475.57	
Advanced payments, Schedule No. 5	1,879.02	
Total current liabilities		$43,354.59
Balance (excess of current assets over current liabilities)		157,078.55
		$200,433.14
Reserve fund.		
Balance, January 1, 1918	$7,894.09	
Cash receipts	240.00	
		$8,134.09
Surplus.		
Balance, January 1, 1918	$95,923.11	
Add: Net profit for the year ended December 31, 1918 (for details see Exhibit A, Schedule No. 6)	53,121.35	
		149,044.46
		$157,178.55

EXHIBIT A.—SCHEDULE No. 1

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED DECEMBER 31, 1918

Balance, January 1, 1918		$13,815.57
RECEIPTS		
Overpayments	$73.63	
Dues	10,743.88	
Subscriptions	3,365.37	
Sale of books purchased	4,310.66	
Advertisements	1,603.85	
Interest on investments—bank balances	4,080.86	
Postage	65.05	
Binding	100.60	
Life membership fee	240.00	
Sale of extra publications	216,078.70	
Sale of Proceedings	885.73	
Credits	111.46	
Sundries	156.52	
Certified checks	11,241.00	
Total receipts		253,057.31
		$266,872.88
Balance, January 1, 1919		**$44,017.33**
DISBURSEMENTS		
Printing and binding Proceedings	$20,441.45	
Printing and binding extra publications	144,219.99	
Salaries	8,430.44	
Contributors	3,318.75	
Authors of books (royalties)	21,766.25	
Postage and telegrams	3,371.92	
Expressage, freight and hauling	2,499.57	
Board meetings	637.68	
Purchase of books for sale	3,164.06	
Office expense—stationery, supplies, etc	2,167.00	
Advertising	451.20	
Prize essay award	200.00	
Certified checks	1,200.00	
First honorable mention award	200.00	
Second honorable mention award	125.00	
Engraving prize essay bar and case	4.50	
Overpayments	122.13	
Purchase Liberty Loan bonds	10,000.00	
Sundries	27.90	
Office furniture	288.61	
Insurance	181.60	
Dues—refunded	37.50	
		$222,855.55
Balance, December 31, 1918		**44,017.33**
		[illegible]

Balance, December 31, 1918			**$44,017.33**
Seaman's Bank for Savings, New York City. Balance as per letter dated January 16, 1919.			$3,000.00
Rhode Island Hospital Trust Co., Providence, R. I. Balance as per letter dated January 16, 1919.			3,865.10
Annapolis Banking and Trust Company, Annapolis, Maryland. Balance as per letter dated January 15, 1919.			8,106.66
Society for Savings, Hartford, Conn. Balance as per letter dated January 16, 1919.			3,921.66
Farmers' National Bank, Annapolis, Maryland. Balance as per statement dated January 3, 1919		$27,995.00	
Less Outstanding Checks.			
#2747	$ 2.50		
3171	1.80		
3439	2.04		
3498	1.50		
3752	8.00		
3926	5.00		
4086	10.00		
4544	5.00		
4590	32.00		
4661	30.00		
4786	5.00		
4801	10.00		
4804	11.68		
4816	19.25		
4817	13.28		
4822	63.09		
4823	23.40		
4824	65.44		
4826	401.94		
4827	30.83		
4829	7.53		
4830	273.02		
4832	457.43		
4833	14.61		
4834	603.00		
4835	21.48		
4836	4.93		
4841	3.26		
4842	32.68		
4844	266.62		
4855	65.44		
4848	30.00		
4850	35.00		
4851	20.00		
4856	25.00		
4858	4.00		
4860	18.00		
4861	52.00		
4862	32.00		
4863	26.00		
4864	63.00		
4865	39.00		
4866	10.50		
4867	10.00		
4868	5.00		
4869	10.00		
4870	1.00		
		2,881.34	
		$25,113.66	$18,893.42

Balance, December 31, 1918			**$44,017.33**
Brought forward		$25,113.66	$18,893.42
Add: Error in check #4646 check drawn for	$16.58		
Stub	15.58		
		1.00	
		$25,114.66	
Add: Foreign drafts out for collection......		9.25	
			25,123.91
			$44,017.33

EXHIBIT A.—SCHEDULE No. 2

SECURITIES (BONDS) DECEMBER 31, 1918

	Par Value	Book Value
Southern Railway (96).		
6 $1000 5% registered gold bonds, #M257-247-475 476-477-478, due July 1, 1994....................	$6,000.00	$5,760.00
Washington Railway and Electric Company (72).		
2 $1000 4% 50-year gold consolidated mortgage bonds, #2183-2184, due July 1, 1951.............	2,000.00	1,440.00
Northern Pacific and Great Northern R. R. (95½).		
8 $1000 joint bonds registered 4%, due July 1, 1921, # M13253-4-5-11769-70-1-11171-2. 2 $5000 C. B. and Q. collateral registered 4%, due July 1, 1921, #5199-5401	18,000.00	17,190.00
Northern Pacific Ry. (60½).		
4 $1000 3% registered gold bonds, #M1610-1-2-1650. 1 $5000 3% registered gold bond, #1123. 3 $1000 3% registered gold bonds, # M21543-4-5, general lien due January 1, 2047................	12,000.00	7,260.00
B. and O. R. R. Company.		
1 $5000 1st mtge. 4% 50-year gold registered, due February 17, 1960, #A436 (80½)...............	5,000.00	4,025.00
1 $1000 1st mtge. 4% 50-year gold registered, due February 17, 1960, #M1230 (80½)...............	1,000.00	805.00
3 $1000 prior lien 3½%, due 1925, #S. M. 383-4-5 (89)	3,000.00	2,670.00
($8,134.09 of these bonds belongs to the Reserve Fund.)		
Potomac Electric Power Company (95).		
2 $1000 5%, #833-4, due June 1, 1929.............	2,000.00	1,900.00
New York City Registered 4¼% (96½).		
1 $7000, #588, due March 1, 1962, corporate stock	7,000.00	6,755.00
3½% Liberty Loan Bonds Registered.		
5 $1000, #6033-4-5-6-7, due June 15, 1947..........	5,000.00	5,000.00
4% Liberty Loan Bonds 2d 1917.		
3 $1000, #16830-1-2, due November 15, 1927.......	3,000.00	3,000.00
4¼% Liberty Loan Bonds.		
5 $1000, #26484-5-6-7-8, due September 15, 1928...	5,000.00	5,000.00
4¼% Liberty Loan Bonds, receipts.................	5,000.00	5,000.00
	$74,000.00	$65,805.00

EXHIBIT A.—SCHEDULE No. 3

ACCOUNTS RECEIVABLE, DECEMBER 31, 1918

Back dues	$2,400.61
Subscriptions	52.59
Advertisements	352.62
Extra publications	71,451.20

EXHIBIT A.—SCHEDULE No. 4

ACCOUNTS PAYABLE, DECEMBER 31, 1918

Lord Baltimore Press	$34,886.00
C. and P. Telephone Company	2.05
R. Beresford	375.90
L. K. Murrill Company	495.85
D. Van Nostrand Company	34.15
Lippincott Co.	29.49
Lucas Brothers	56.88
Baker and Taylor	1.80
Meyer and Thalheimer	20.73
Wiley and Sons	9.38
Little, Brown and Company	3.35
Longmans, Green and Company	7.31
Century Company	2.52
Doubleday, Page and Company	2.76
Lea and Febiger	1.70
Funk and Wagnalls Company	4.13
E. P. Dutton and Company	3.02
Macmillan Company	2.50
McGraw Hill Book Company	3.40
A. and C. Black	1.38
Stevens and Brown	3.88
Inter Film Service	2.00
Blackiston Sons and Company	3.70
American R. R. Express Company	952.15
Roycrofters	1.60
Scribner's Sons Company	30.66
E. N. Appleton	3,710.85
James Gantt	5.76
Postmaster, Annapolis, Maryland	41.90
Naval Academy Officers' Mess	1.40
Western Union Telegraph Company	3.09
H. K. Fly Company	1.81
Putnam's Sons	3.60
E. Wilkinson	150.45
Sundry authors, royalties	588.42
Overpayments	30.00
	$41,475.57

EXHIBIT A.—SCHEDULE No. 5

ADVANCED PAYMENTS, DECEMBER 31, 1918

Advertisements	$13.50
Dues	1,227.19
Subscriptions	638.33
	$1,879.02

EXHIBIT A.—SCHEDULE No. 6

STATEMENT OF INCOME AND EXPENSES FOR THE YEAR ENDED DECEMBER 31, 1918

Inventory, January 1, 1918.			
Extra publications	$9,314.26		
Extra numbers of Proceedings	300.00		
		$9,614.26	
Add: Purchases for year.			
Books for sale	$3,308.96		
Printing and binding Proceedings	21,399.23		
Printing & binding extra publication.	172,467.02		
		197,175.21	
		$206,789.47	
Deduct: Inventory, December 31, 1918.			
Extra publications	$15,159.96		
Extra numbers of Proceedings		15,159.96	
			$191,629.51
Expressage, freight and hauling	$2,994.33		
Contributors	3,318.75		
Authors of books (royalties)	15,584.87		
Prize essay award	200.00		
First honorable mention award	200.00		
Second honorable mention award	125.00		
Postage and telegrams	3,350.00		
Engraving prize essay bar and case	4.50		
			25,777.45
Cost of publications sold			$217,406.96
Profit on sale of publications, etc.			59,323.91
			$276,730.87
EXPENSES			
Salaries		$8,430.44	
Office expenses		2,081.27	
Board meetings		637.68	
Insurance		101.60	
Lawyer's fee		150.45	
Advertising		451.20	
Total expenses		$11,852.64	
5.45% on cost.			
4.77% on sales.			
Bonds charged off	$8,195.00		
Furniture charged off	1,139.36		
		9,334.36	
Total deductions		$21,187.00	
			21,187.00
Excess of income over deductions transferred to surplus			53,121.35
			$74,308.35
Sale of extra publications			$267,092.90
Sale of books			4,310.66
Sale of Proceedings			885.73
Total sale of publications			$272,289.29
Subscriptions			2,776.63
Advertising			1,564.35
Binding			100.60
Total sale of publications, etc.			$276,730.87

INCOME

Profit on sale of publications, etc.	$59,323.91
Dues	10,626.80
Interest on investments	4,080.86
Miscellaneous	276.78
	$74,308.35

This report of audit was accepted and approved by the Board of Control, for publication, January 31, 1919.

G. M. RAVENSCROFT,
Secretary and Treasurer,
U. S. Naval Institute.

THE 7" NAVAL TRACTOR MOUNT FIRING AT 30° ELEVATION. SEE PROFESSIONAL NOTES UNDER ORDNANCE AND GUNNERY.

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

FRANCE.

A New French Cruiser.—Reports from Paris indicate that the *Lamotte-Piquet*, the nameship of a new class of light cruisers, is either completed or approaching completion. It is nearly 20 years since France launched a vessel of this type, preference having been given to large and expensive armored cruisers, which have proved very wasteful to run, and much too slow to be of value as scouts. The *Lamotte-Piquet* is a distinctive design, and appears to possess several points of advantage over her foreign contemporaries. She is 453 ft. in length, 45¼ ft. in beam, draws 16½ ft., and displaces either 4100 or 4500 tons. She is fitted with Parsons turbines, driving four shafts, and has twelve Du Temple-Guyot boilers, of which eight are oil-fired. The turbines are expected to develop 42,000 horsepower, giving a speed of 32 knots. The armament comprises eight 5-inch Q. F. guns of a new model, 55 calibers in length, using an 81-lb. projectile, and so disposed as to give a broadside of six and an end-on fire of four guns, all of which have excellent arcs of fire. Unusually good protection to the gun crews is afforded by 6-inch shields, while four of the weapons are mounted in broadside casemates of the same thickness. The hull for two-thirds of its length is protected by a 2-inch belt, associated with a ¾-inch deck. The *Lamotte-Piquet* was built at Toulon, and her two sisters at private yards. They are officially styled "conveyeurs d'escadrilles."—*The Engineer* 13/12.

French Fleet Bound for German Ports.—Announcement was made at the Ministry of Marine to-day that a French naval division, composed of five units, of which the armored cruiser *Montcalm* is the flagship, is on its way to the Baltic Sea, having received orders to survey the carrying out by the Germans of the clauses of the armistice.

The vessels also will visit German ports where French prisoners are assembled in order to insure their repatriation under the best possible conditions.—*N. Y. Times*, 23/12.

FRANCE TO DOUBLE ITS MERCHANT FLEET.—According to the Paris *Matin*, Fernand Bouisson, Under Secretary of State for the Merchant Marine, has announced that within five years France will have merchant ships with a total capacity of 6,000,000 tons, which is double its pre-war tonnage. It is said that the greater part of the fleet will be composed of new vessels.—*Nautical Gazette*, 11/30.

FRENCH CASUALTIES AND COSTS.—The French High Commission authorizes publication of the following:

FRENCH LOSSES DURING THE WAR

Up to November 1, 1918:	
Dead (killed in action and dead of wounds)	1,028,800
Missing (given up for lost)	299,000
Total (Colonial troops not included)	1,327,000
Colonial troops:	
Dead	42,500
Missing	15,000
Grand total of dead and missing	1,385,300
Wounded (about)	3,000,000
[Of which 700,000 crippled and pensioned. To this figure must be added a great number of the 435,000 Frenchmen war prisoners henceforth unfit to work.]	
Grand total of French casualties	4,385,300

COST OF WAR TO FRANCE

Expenses—$23,500,000,000 (up to December 31, 1918)
Damages—$13,000,000,000 (approximate figure).
Pensions—$8,000,000,000 (approximate figure).
—*U. S. Bulletin*, 14/1.

GERMANY

CAPTAIN PERSIUS ON GERMAN SUBMARINES.—The naval critic, Captain Persius, recently stated in the Berlin press that in 1917 only 83 submarines were constructed, while 66 were destroyed. He tells us that in April, 1917, Germany had 126 submarines and in October, 146. In February, 1918, she had 136 and in June of this year, 113. He verifies the statement of Admiral Sims that very few submarines operated at one time. In January, 1917, only 12 per cent were active, while 30 per cent were in harbor, 38 per cent under repairs and 20 per cent incapacitated. Submarine crews were insufficiently trained and distrusted the submarine, while experienced seamen looked upon the submarine warfare as a "political stupidity."—*Scientific American*, 21/12.

FINDS 170 U-BOATS BEING BUILT.—One hundred and seventy submarines, all under construction, were found when the Interallied Naval Commission visited Germany to make arrangements for the carrying out of the terms of the armistice, according to newspapers here. These U-boats, it is said, will be turned over to the Allies.—*Wash. Evening Star*, 4/1.

ALLIES WILL DESTROY PARTLY BUILT U-BOATS.—*New Armistice Terms Penalize German Trick—Our Commissioners go to Treves.*—The four

American armistice representatives left Paris to-day for Treves, where Marshal Foch is presenting the new terms to the German commission. The party consisted of Admiral William Shepherd Benson, Chief of Operations of the United States Navy; Norman H. Davis, representing the United States Treasury; Edward N. Hurley, Chairman of the American Shipping Board, and Louis P Sheldon, who will represent Herbert C. Hoover, the American Food Administrator.

A report presented to the council having charge of the carrying out of the naval items of the armistice stated, according to the morning newspapers, that the Interallied Commission which visited Kiel and Wilhelmshaven discovered submarines under construction in slips, which the enemy thought would be overlooked. The report adds that the Germans contended that they were entitled to regain possession of the underwater craft.

According to the report, the discoveries at Kiel and Wilhelmshaven led to the finding of other vessels, and consequently the new terms of the armistice will require the surrender of all submarines already built and the destruction of those on the ways.

It is also understood that the terms for the extension of the armistice provide for the turning over of the German commerical fleet to transport troops, in exchange for food, for the restitution of material taken from France and Belgium and for full compliance with the terms of the original armistice.

The economic terms approved by yesterday's session of the Supreme War Council require that Germany shall hand over to the Allies all her cargo steamers in German and other ports to enable the Allies to revictual Germany and such adjacent countries as may be decided upon. The terms also require the restitution of all manufacturing machinery, etc., taken from the invaded regions, which it is possible to identify. This was decided upon in the view that it would bring about a quicker revival of economic life than the payment of an equivalent in money.—*N. Y. Times*, 15/1.

A REMARKABLE ZEPPELIN FLIGHT.—From Germany now comes a startling story of the trip of a Zeppelin in November, 1917, which is of considerable interest despite the fact that it is over a year old. It appears that a Zeppelin started from Bulgaria for East Africa with 22 tons of munitions and medicines and a crew of 22. It had arrived over Khartoum, in the Sudan, when it was ordered by wireless to return because it was learned that the bulk of the forces of General von Lettow Vorbeck, the German commander in East Africa, had surrendered. It returned to its starting point four days after it had left. The Germans claim that this airship could have made a round trip between Berlin and New York, without stopping. It is also learned that the Zeppelin factory at Friedrichshafen is building an airship for transatlantic traffic, capable of carrying 100 passengers. It has nine engines and eight propellers. If the international situation clears up by next summer, the first flight will probably be made in July. The flight is expected to be made in 40 hours.—*Scientific American*, 28/12.

TO GET BATTLESHIP "BADEN."—*Allies Will Receive New German Craft at British Port.*—Germany's newest battleship, the *Baden*, will be surrendered at a British port within a few days, in accordance with the terms of the armistice, according to announcement here.

The *Baden* has a displacement of 28,000 tons. Owing to the fact that this ship was completed after the war began, little is known as to its armament. It has been reported that ships of this class had been armed with 16.5- or 17-inch guns, but information on this point has been meager and unreliable.—*N. Y. Times*, 4/1.

WHY THEY GAVE UP THE "-U-9."—*German Crew Cared More for $125 Bonus Than for "Glorious Record."*—Although Admiral Beatty, Commander of the British Grand Fleet, refrained from requiring the delivery

of the German submarine *U-9*, with which Commander Weddigen torpedoed and sank three British cruisers, out of consideration for the "glorious record" of his boat, says the *Cologne Volkszeitung*, the submarine was delivered to the British because the German crew was unwilling to forego the opportunity of earning the 500 marks promised to each for taking the boat to England.—*N. Y. Times*, 23/12.

INSIST ON PAYMENT FOR U-BOAT RAVAGES.—In the absence of a definite policy from the Allies concerning the manner in which Germany shall make compensation for the dependents of submarine victims among seamen, the Executive Committee of the International Federation of Seafarers has evolved a plan by which the officials hope to force the Peace Conference to act. The committee has called an internationl conference in London, on February 24, at which the British delegates will present a resolution providing that the seamen will not man any ships going or coming from an enemy country until the proper compensation is agreed upon.—*N. Y. Times*, 16/1.

CASUALTIES IN THE WAR.—An exchange telegraph dispatch from Copenhagen states that Austria-Hungary suffered a total of over 4,000,000 casualties in killed and wounded, the total number killed being 800,000 men and 17,000 officers. The Socialist *Vorwarts* of Berlin places the total German losses at 6,330,000, of which about 1,600,000 were killed and the fate of 260,000 is unknown. The total number of prisoners is put down as 490,000.—*Scientific American*, 21/12.

GREAT BRITAIN

BRITISH WARSHIPS COMMISSIONED SINCE 1914.—The following table shows all battleships commissioned subsequent to August 1, 1914:

Name	Displacement	Builder	Laid down	Completed
	Tons			
Benbow	25,000	Beardmore	May, 1912	Aug., 1914
Emperor of India	25,000	Vickers	May, 1912	Sept., 1914
Erin	23,000	Vickers	Feb., 1911	Aug., 1914
Agincourt	27,500	Elswick	Sept., 1911	Aug., 1914
Canada	28,000	Elswick	Dec., 1912	1915
Queen Elizabeth	27,500	Portsmouth	Oct., 1912	Nov., 1914
Warspite	27,500	Devonport	Oct., 1912	1915
Valiant	27,500	Clydebank	Feb., 1913	1915
Barham	27,500	Fairfield	Jan., 1913	1915
Malaya	27,500	Elswick	Oct., 1913	1915
Royal Sovereign	25,750	Portsmouth	Jan., 1914	1915
Royal Oak	25,750	Devonport	Jan., 1914	1915–16
Resolution	25,750	Palmer	Nov., 1913	1915–16
Ramillies	25,750	Beardmore	Nov., 1913	1915–16
Revenge	25,750	Vickers	Dec., 1913	1915–16

Of the above ships, *Benbow* and *Emperor of India* belong to the *Iron Duke* class. The *Agincourt* had originaally been laid down at Elswick for Brazil, but before completion was sold to Turkey for £2,725,000. In July, 1914, she was completing her trials at Devonport, where she was taken over for the British Navy, and named the *Agincourt*. The peculiarity of this ship is her powerful armament, consisting of fourteen 12-inch guns, all of which are disposed in double turrets on the center line of the ship; and twenty 6-inch Q. F., in addition to many smaller guns. The *Erin* was

originally laid down for Turkey as the *Rechadieh*, but was appropriated by the British Admiralty early in August, 1914. In general design and armament she closely resembles the *Iron Duke* class. The *Canada* was laid down for the Chilean Government, purchased in 1914 for the British Navy, and commissioned in the following year. Her main battery of ten 14-inch guns introduced a new caliber into the British service, though since then certain vessels of the *Monitor* class have been armed with the guns of this size.

The main features of the *Queen Elizabeth* class are too well known to need repetition, but it may be said that the vessels have been uniformly successful in service, and, by common consent, are among the very finest battleships now afloat. The five *Royal Sovereigns* are slightly smaller and considerably slower editions of this class, but in all other respects, including armament and protection, they are identical with the *Queen Elizabeth*. Their main dimensions are: Length, 624¼ ft.; beam, 88½ ft.; draught, 27 ft.; displacement, 25,750 tons. They have Parsons turbines and Babcock or Yarrow boilers, which, at first designed for coal, were afterwards altered for liquid fuel.

Information relative to battle cruisers added to the fleet since the beginning of the war is less definite. Only one vessel of this type, viz., the *Tiger*, was in hand in August, 1914, and she was commissioned two or three months later. When laid down at Clydebank in June, 1912, she was intended to be sister to the *Lion*, but before the launch important modifications were made in the plans, which delayed her completion. The principal details are: Length, 675 ft.; beam, 90 ft.; draught, 30 ft.; displacement, 28,500 tons—full load about 32,000 tons. She has turbines of the Brown-Curtis system designed for 87,500 horsepower, equivalent to 28 knots. She carries the same main armament as the *Lion*, but mounts a more powerful auxiliary battery, viz., twelve 6-inch guns.

In August, 1914, sixteen light cruisers of the *Arethusa* and *Calliope* classes were completing or building, and four others had been authorized. Generally speaking, these twenty ships were of uniform type, and had the following characteristics: Displacement, 3500 to 3750 tons; speed, 30 knots—Parsons or Brown-Curtis turbines, Yarrow boilers, oil-fired—armed with two or three 6-inch Q. F., several 4-inch Q. F., and four deck torpedo tubes. There was a thin armor belt in conjunction with protective decks. A slightly larger and faster class includes the *Caledon*, *Calypso*, *Curaçao*, *Cardiff*, *Coventry*, etc., launched 1916-17, displacing 4000 tons, with a speed of 32-33 knots, and armed with six 6-inch Q. F. The *Brisbane* and *Adelaide* were built in Australia, the former being completed two years ago, while the latter was launched this year. They belong to the *Town* class, displace 5600 tons, and have a speed of 25 knots, the armament consisting of eight or nine 6-inch Q. F. *Chester* and *Birkenhead* were originally laid down in England for the Greek Government as the *Condouriotis* and *Lambros Katsonis*, but were purchased by Great Britain at the opening of hostilities. They are of 5500 tons, with a speed of 25.5 knots, and are armed with eight 5.5-inch Q. F. Although the foregoing list is probably incomplete, it is enough to show that since 1914 the British Navy has been very powerfully reinforced by light cruisers.

A special type of vessel was designed early in the war for mine-sweeping, anti-submarine work, and general patrol duties, known officially as the *Acacia* class and popularly as the *Herbaceous* class. Considerably more than 100 representatives of this type have been built, the principal details being: Length, 262 ft.; displacement, 1800 tons; speed, 16 to 18 knots, armed with one or two 6-inch Q. F and smaller guns; depth charges, etc.

A considerable number of new gunboats has been added to the navy, among them being five vessels of the *Soldier* class, 1500 tons and 16 knots speed, built in Japan for service in the Far East. Another group, known as the *Insect* class, was built by Messrs. Yarrow especially for

service in Mesopotamia, the main details being: Length, 230 ft.; beam, 36 ft.; displacement *circa* 1000 tons; armament, two 6-inch and smaller Q. F. Twelve smaller gunboats, known as the *Fly* class, were also built in England, shipped in sections to Abadan, Mesopotamia, and there assembled and armed for service on the Tigris and Euphrates. Dimensions: Length, 120 ft.; beam, 19.7 ft.; draft, 2.6 ft.; armed with one 4-inch., also 6-pounder Q. F. and machine guns.

Of the 200 or more destroyers which have been completed since the outbreak of war full particulars are not yet available, but they are understood to be similar in many respects to the *L* and *M* classes completed between 1913-1915. Displacements range from 965 to 1000 tons, speed nominal, from 30 to 35 knots, and the armament comprises three or four 4-inch Q. F., one 3-inch anti-aircraft gun, and four 21-inch torpedo tubes. In all the later boats broadside fire has been increased by adopting the center-line position for all guns.

A larger class of destroyers, known as flotilla leaders, completed during the war, comprised at least 13 boats. They are understood to displace about 1200 tons, with a designed speed of 32 knots, and to be armed with four 4-inch Q. F., one 3-inch A.-A. gun, and four torpedo tubes.

We would emphasize the fact that the vessels enumerated in the foregoing do not by any means include *all* the new construction undertaken for the British Navy since the outbreak of war, and that the particulars may need correction, but the information given is sufficient to convey some idea of the huge scale of naval construction in this country, during the past four years.—*The Engineer*, 29/11.

Note: No information regarding battle cruisers, submarines or monitors, etc.

Destroyers, as is well known, have played a leading part in the defeat of Germany at sea. Not merely did they get home again and again on the German Fleet as it fled from the Jutland battle, but the destroyers have been the terror of the U-boat. For obvious reasons it has not been possible to publish until now any details of the more recent of our additions to these craft, but the declaration of the armistice has relaxed the restrictions in vogue, and we are thus enabled to give an illustration and some particulars of the destroyer *Mounsey*, the boat which, under the command of Lieutenant Craven, saved, under circumstances of very great difficulty, no less than 696 lives when the *Otranto* was torpedoed on October 6 last. The sea at the time was exceedingly rough, and it would have been fatal to have brought a lightly constructed vessel like the *Mounsey* alongside of the cruiser. The saving of life was therefore effected by maintaining the *Mounsey* under way, so that she passed the *Otranto* within a few feet, allowing the people to jump from one ship to the other. The maneuver had to be repeated many times, and was, under the circumstances, a very original and successful method of rescuing those endangered without great risk to the destroyer herself.

The *Mounsey* was built by Messrs. A. F. Yarrow and Co., Ltd., at their Scotstoun works, and on her measured mile trials attained a speed of over 39 knots. This trial was run with the boat fully armed and equipped, and with sufficient fuel on board for a run of 1000 miles at an economical speed. Further particulars are given below:

Length between perpendiculars	260 ft. 3 in.
Length overall	271 ft. 6 in.
Beam	25 ft. 7½ in.
Depth, midships	16 ft. 3 in.
Total heating surface	22,017 sq. ft.
Four hours' trial—	
Draft forward, 8 ft. 1½ in.; draft aft, 8 ft. 2¼ in.	=835.3 tons at yard.

Speed, 4 hours ....38.605 knots.
Speed on measured mile ....39.018 knots.
Revolutions per min., 4 hour trial ....685.6.
Revolutions per minute on measured mile trial ....693.02.
Oil consumed in 4 hours ....57.33 tons.
Load on trial ....158 tons.
Oil fuel capacity ....228 tons.
Radius of action at full speed ....615 miles

Armament—
Three 4-inch quick firers; two 2-pounders; two twin 21-inch torpedo tubes.

Complement—79.

PARTICULARS OF RUNS ON MEASURED MILE

No.	Hour, p. m.	Boiler steam	Vacuum	Air pressure	Revolutions	Time on miles	Speed
1.......	1.45	259	28	6.5	689.0	1-32.4	38.962
2.......	1.54	257	28	6.5	692.0	1-32.4	38.962
3.......	2.4	257	28	6.5	693.0	1-32.2	39.056
4.......	2.13	258	28	6.5	693.5	1-32.0	39.130
5.......	2.24	258	28	6.5	694.0	1-33.0	38.710
6.......	2.34	259	28	6.5	692.75	1-31.4	39.388
Mean on measured mile............		258	28	6.5	693.023	......	39.018
Mean in 4 hours..		258	28	6.4	685.6	......	38.605

—*Engineering*, 13/12.

BRITISH SUBMARINES DESTROY MANY ENEMY CRAFT.—Details can now be given of the part which British submarines played during the war. This service destroyed the following enemy warships:

Two battleships, two armored cruisers, two light cruisers, seven destroyers, five gunboats, twenty submarines and five armed auxiliary vessels.

Three battleships and one light cruiser were torpedoed but reached port badly damaged.

Other enemy craft destroyed were:

One Zeppelin, fourteen transports, two ammunition and supply ships, two more ships, fifty-three steamships and 197 sailing ships.

In no case was a merchant ship sunk at sight. Care was taken to see the crews of all vessels got away safely.

In addition to carrying out their attacks on enemy war craft, the submarine commanders carried out 24 cruises, totaling 22,000 miles, which probably constitutes a record for any submarine.—*Naval Monthly*, 18/12.

NORTH SEA BLOCKADE.—The First Lord of the Admiralty (Sir Eric Geddes), speaking at the "Sea Power Exhibition" on December 4, said it was the blockade which crushed the life out of the Central Empires. Largely that blockade was carried out by the Tenth Cruiser Squadron with its flagship the *Alsatian*, which from 1914 to 1917 held the 800 miles of grey seas from the Orkneys to Icelands, and which had intercepted 15,000 ships conveying succor to the enemy. That service had been performed in Arctic conditions of storm, blizzard, and ice, and yet, in spite of almost impossible conditions, only four per cent of the vessels were missed.—*Army and Navy Gazette*, 14/12.

BRITISH SHIPS SUNK DURING THE WAR.—Sir Eric Geddes states that during the war 2475 British ships were sunk with their crews beneath them, and 3147 vessels were sunk and their crews left adrift. The personnel of the merchant marine service was heavily hit, the total number of casualties exceeding 15,000 men. The U-boats carried on continuous warfare against the fishing fleets; the total number of fishing vessels sunk being 670.—*Scientific American*, 21/12.

CANADA'S SHIPBUILDING IN WAR PERIOD.—Some 360 ships were constructed in Canada for Canadian registry during the period of the war to the end of November. Of the number, 199 were sailing vessels, aggregating 44,135 gross tons, and 160 were steamships, totalling 69,612 tons. In addition, 22 ships were built through the Imperial Munitions Board for the British Government. Of the number, there were 15 each of 1400 net tons and 7 each of 2600 net tons.

Contracts for 42 steel steam vessels, with an aggregate capacity of 255,250 tons, have been placed under the Dominion Government's shipbuilding program; of these, two have been launched at Montreal.

The total capacity of Canadian shipyards is 460,000 tons a year.—*Nautical Gazette*, 14/1.

LOSSES FROM COLLISIONS DURING THE WAR.—It is hoped, says London *Fairplay*, that the serious losses from collision which have been such a feature for the last two years will be sensibly lessened with the cessation of the convoy system. There is still, however, the difficulty due to the "dazzle" system of painting vessels, for, although this system handicapped a submarine commander in judging the position and direction of a vessel, it would handicap the master of an approaching vessel in a similar fashion. The number of vessels sunk by collision in November was eight, and the total number sunk for the eleven months this year is 90. The totals for the three previous years are as follows:

1915	25 vessels.
1916	33 vessels.
1917	66 vessels.

It will be seen, therefore, that under ordinary conditions the total losses for 1918 are likely to reach a figure which is 50 per cent more than in 1917 and 300 per cent more than in 1916.

THE ROYAL AIR FORCE.—For the first time during the war, it is possible to disclose official details of the remarkable fighting aircraft which enabled the Royal Air Force to play so notable and conclusive a part in the aerial defeat of Germany and her Allies. It is well known that during the final stages of the war Great Britain has been turning out large numbers of the fastest and most powerfully armed aircraft in the world. Indeed, the collapse of Germany in the air, which was so noticeable a feature of the last phase of the operations, was largely due to the fact that, not only was she confronted with an air force immensely superior to her own in all those personal qualities which constitute fighting morale, but that she was at last definitely outclassed in the speed, climb and fighting efficiency of the super-aircraft which British inventive genius brought into the field. Roughly, the machines employed by the Royal Air Force upon the fighting fronts may be divided into three groups: (1) Reconnaissance Machines: Used for contact patrol work over the lines, the direction of artillery fire, photography, and general strategical reconnaissance. (2) Heavy Bombers: Capable of travelling long distances without escort, and carrying heavy loads of bombs in addition to defensive armaments. (3) Fast Fighting Scouts: Possessing exceptional climbing powers, heavily armed, and capable of maneuvering at a very high rate of speed.

The earliest type of British reconnaissance machine was the now famous *B.E.-2 C,* designed and produced by the Royal Aircraft Factory at Farnborough. The design was completed just prior to the outbreak of war, a fact which facilitated immediate production for the use of the Expeditionary Force. As far as possible, speed, climb and maneuvering ability were combined, although compared with modern types it was a relatively slow machine, making only 50 miles to 60 miles an hour with the 80 h. p. engine with which it was originally fitted. This was followed by the Armstrong-Whitworth *F K.-8,* fitted with 160 h. p. Beardmore engines which made an average speed of 82 miles an hour and could climb to 10,000 feet in about 27 minutes. Towards the end of 1916, an immense forward stride was taken by the production at the Royal Aircraft Factory of the *R.E.-8* with a 12 cylinder R. A. F. engine. This machine has done the bulk of the artillery observation work in France, directing all big-gun fire and barrage work. At 10,000 feet it has a speed of 92 miles an hour, and can climb to that height in 11 minutes. It is fitted with camera and wireless equipment, and takes photographs of every "shoot." An even bigger advance was marked by the introduction of the *Bristol Fighter,* a long distance fighting reconnaissance machine, capable of travelling at 113 miles an hour at 10,000 feet, and climbing to that height in 11 minutes. Had the war continued, the *Bristol Fighter* would have entirely replaced the *R.E.-8* for long distance artillery work.

Aerial bombing was first undertaken in France by the *Avro,* a machine of moderate speed fitted with an 80 h. p. Gnome engine. The observer's seat was used as a receptacle for the bombs, which were merely thrown overboard without the aid of the scientific bombing sights and elaborate bomb-dropping gear which have since contributed so largely to the wonderfully accurate shooting made during the raids upon Germany. The first British machine specially constructed for bombing purposes was the *Short,* a modified seaplane, fitted with a 250 h. p. engine, and carrying four 112-lb. bombs under each wing. This type, which did most useful work in France, was followed by the *Sopwith 1½ Strutter,* and later by the highly-improved *D.H.-4* and *D.H.-9* machines. The *D.H.-4* machine was originally designed as a fighter, but its trials disclosed such excellent lifting powers that it was converted to bombing purposes. It is capable of climbing to 10,000 feet in nine minutes, and has an endurance of three and three-fourths hours. The *D.H.-4* and *D.H.-8* machines have been fitted with Rolls-Royce, B. H. P., and latterly the Liberty engines.

Finally, the great Handley-Page machines were devised for the bombing of Germany. The first quantity production was begun in August, 1917, and the performance of the machine has justified the highest expectations. It is capable of carrying 2000 lb. weight of bombs in the fuselage, or 1500 lb. to suspend externally. The machines used by the Royal Aircraft Independent Force, in the bombing of Germany have been the Handley-Page, *D.H.-4, D.H.-9,* and *Sopwith Camel.* Not until the middle of 1915 were production machines armed with standard equipment. Two of the earliest types were the *F.E.-2 B.* and the *Vickers' Fighter.* Both had an open cockpit, and were equipped with Lewis or Vickers' machine guns. The year 1916 witnessed the introduction of the fixed machine gun firing through the propeller and fitted with the ingenious Constantinesco interrupter gear. Other types followed, rapidly leading up to the *S.E.-5 a,* and lastly the *Sopwith Dolphin,* the best and latest British fighting scout in the field. Both these types were in use at the termination of hostilities. Some idea of the power of these modern aircraft can be gained from the fact that the *Dolphin* travels at 128 miles an hour at 10,000 feet, and climbs to that height in 8¼ minutes. It lands at upwards of 55 miles an hour. The following table shows the performance of the leading British types. (At lower altitudes the machines will, of course, develop higher speeds):

Machine	Speed at 10,000 feet	Time required to climb 10,000 feet	Continuous flight capacity
		Minutes	*Hours*
F. E. 2 B	76	40	3½
Vickers' Fighter	76	40	3½
Sopwith 1½ Strutter	103	10	—
Bristol Scout	111	10	1¾
A. W	88	27	3
Sopwith Camel	118	10	2½
D. H. 4	120	11	4
D. H. 9 A	120	11	6
Bristol Fighter	113	11	3
S. E. 5 A	126	10	3
Dolphin	128	8¼	1¾

—*Engineering*, 29/11.

BRITISH AIRSHIPS.—In 1909, the Admiralty decided to experiment with rigid airships, the outcome of this decision being *Naval Airship No. 1*, which showed by its failure to rise that it was not a simple matter to construct these vessels, and when lightened by alteration of construction, it broke in two in 1911. It was given out the following year that the prospects of using this type of airship were not sufficient to justify the great cost. The nation that was to be our main enemy in the greatest war of all time thought otherwise, and backed their opinion, continuing to construct and improve on the Zeppelin model, with the result that on many occasions, and notably in their dire need at the battle of Jutland Bank, they reaped the reward of their consistent policy of enterprise and at relatively infinitesimal cost. At the outbreak of hostilities Great Britain had only seven airships, all of the non-rigid type, four of which had been taken over by the Admiralty on December 31, 1913, and of the remaining three, *No. 2* was the model on which all the S. S. (submarine scout) class of vessel have since been based; *No. 3* was an Astra-Torres of trefoil section with internal rigging, and *No. 4* was a Parseval bought from Germany. It was the irony of fate that this particular vessel should have been used to patrol the Channel on the night of August 5 and 6, 1914, following up the declaration of war with that country.

Since then, four types of non-rigid airships have been constructed for naval account in Great Britain—*Parseval, Submarine Scout, Coastal,* and *North Sea.* The second of these is rigged externally to *Eta* patches on the envelopes, these patches deriving their name from one of the four army airships alluded to above, on which they were first used. The two last-named are constructed on the Astra system. The year 1915 saw the first building of small S. S. airships, and they repaid their cost many times over; the original model consisted of an aeroplane body with super-imposed more or less stream-lined envelope; this was followed by S S. *Zero*, a vessel of 70,000 cubic feet capacity, with a blunt-nosed envelope 145 feet in length, and a main diameter of 29 feet. The longest flight of one of these vessels was just under 51 hours. In 1917 the S. S. *Twin* made its appearance, its length is 164½ feet, main diameter about 32 feet, cubic capacity 100,000 feet, the car carries a crew of three, and this class of airship has been found so eminently satisfactory that no more of the previous S. S. models will be built. The motive power is supplied by twin engines, two 75 h. p. Hawks. The *Coastal* type has a capacity of 200,000 cubic feet, and the car will hold five men. Airships of this type did most of the long distance patrols during the last two years, and were largely employed in convoying ships from beyond the Scilly Isles up the Channel. An improved

model of this class known as *Coastal Star* was brought out in January, 1918; it is somewhat larger, and the envelope better stream-lined. The motive power is provided by a 110 h. p. Berliot forward, and a 260 h. p. Fiat aft. The *North Sea* type was designed to act as a scout with the fleet, or to carry out patrols of 20 hours. Its envelope has a cubic capacity of 360,000 feet, and the normal crew is 10 men, but the car will carry 20. Since the signing of the armistice, one of these vessels has made a record voyage for a non-rigid airship of 61 hours 21 minutes, and is understood to have been surpassed on two occasions only by Zeppelins. This class are 262 feet in length, main diameter 55 feet, and they are fitted with two 275 h. p. Eagle or two 260 h. p. Fiat engines. Since 1911 no rigid airship was built in Great Britain till 1916; by January 1, 1918, four of these vessels were in commission. The largest of the four has a capacity of 1,500,000 cubic feet, but larger vessels are under construction. As the rigid vessel has proved its great value for long distance naval reconnaissances, and as the best scout with a fleet, we may expect to see serious attention paid to the development of the type.—*Army and Navy Gazette*, 14/12.

AERIAL COASTGUARD.—*Methods and Machines.*—There were two kinds of anti-submarine patrol, intensive and extensive. The intensive kind was concerned with spotting and escorting in the war channel. This was an area extending from the coast line to a line marked in some parts with numbered buoys about ten miles out. All convoys kept within this line. For inshore work from three to five miles the *D. H.-6* machine was used. The old *D. H.-6*, familiarly known as the *Clutching Hand* and as a *School 'Bus*, was capable of about one and one-half hour's patrol on the average. It was altered in design for this work and turned also into a single-seater, the patrols being usually done in pairs. Further out again went the seaplanes and the *D. H.-9*, often beyond the 30 mile line. The *D. H.-9* had the advantage of greater speed than any other anti-submarine patrol craft, and was, therefore, particularly useful in heavy weather or in a sudden emergency demanding swift action. Beyond this again went flying boats and airships. The war channel was thus patrolled by every form of aircraft, though many went further to sea than the safety line for shipping. German submarines were nearly always sighted within the war channel area. They knew, of course, of its existence, and came there for their prey.

U-Boat Movements and Methods.—All aircraft on these Royal Aircraft Force patrols were under the direction of the senior naval officer of the group to which the squadrons were attached. In this way the machines were used in conjunction with the surface craft and the hydrophone stations, and there was, in fact, splendid and wonderfully effective collaboration between the forces of the sea and the forces of the air. The study of the movements and methods of enemy submarines had become such an exact science that it was often possible to tell in advance when and where to expect the next attack. How true this is may be gauged by the fact that there were scarcely any successful attacks on shipping (attacks after which the submarine escaped) during flying hours. This year the Germans initiated an air offensive against our anti-submarine patrol. It took the form of very fast monoplanes, heavily armed. Consequently we retaliated by escorting our flying boats and other craft with a purely fighting machine, such as the *Sopwith Camel.*

The following figures give a slight idea of the work of the Royal Aircraft Force anti-submarine patrol. They refer only to the half-year since the Royal Aircraft Force became a separate force—from April 1 to October 31 last:

Total number of hours flown	39,102
Hostile submarines sighted	216
Hostile submarines attacked	189
Hostile aircraft attacked	351
Hostile aircraft destroyed	184
Hostile aircraft damaged	151

Hostile mines spotted	69
Hostile mines destroyed by aircraft	32
Total number of bombs dropped	15,313
(This is equal to 661½ tons)	
Total convoy flights	3,441
Total photographs taken	3,440

This brief record of the Royal Aircraft Force coast patrol in home waters does not touch upon the vast air patrol organization in the Mediterranean, and it includes a final period during which German submarine work had greatly decreased.—*London Times*, 16/12.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, DECEMBER 31, 1918

Type, number and name	Contractor	Per cent of completion			
		Jan. 1, 1919		Dec. 1, 1918	
		Total	On ship	Total	On ship
Battleships					
42 Idaho	New York S. B. Co	98.5	98.5	98.1	98.1
43 Tennessee	New York Navy Yard	57.4	51.2	51.1	43.8
44 California	Mare Island Navy Yard	51.	36.4	48.4	32.8
45 Colorado	New York S. B. Co	6.8	.4	6.8	.4
46 Maryland	Newport S. B. & D. D. Co	38.9	28.8	38.2	27.3
47 Washington	New York S. B. Co	4.3	.4	4.3	.4
48 West Virginia	Newport S. B. & D. D. Co	18.8	2.1	18.7	2.1
49 South Dakota	Navy Yard, New York	0.	0.	0.	0.
50 North Carolina	Navy Yard, Norfolk	0.	0.	0.	0.
51 Montana	Navy Yard, Mare Island	0.	0.	0.	0.
52	Navy Yard, New York	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co	0.	0.	0.	0.
2 Constellation	Newport News S. B. & D. D. Co	0.	0.	0.	0.
3 Saratoga	New York S. B. Co	0.	0.	0.	0.
4 Ranger	Newport S. B. & D. D. Co	0.	0.	0.	0.
5 Constitution	Philadelphia Navy Yaad	0.	0.	0.	0.
6	Phila. Navy Yard	0.	0.	0.	0.
Scout Cruisers					
4	Todd D. D. & Const. Co	25.2	1.8	32.4	2.1
5	Todd D. D. & Const. Co	21.9	.9	21.5	.2
6	Todd D. D. & Const. Co	17.6	.6	17.	.2
7	Union Iron Works	0.	0.	0.	0.
8	Union Iron Works	0.	0.	0.	0.
9	Wm. Cramp & Sons Co	9.	....	9.	....
10	Wm. Cramp & Sons Co	9.	....	9.	....
11	Wm. Cramp & Sons Co	....	....	....	....
12	Wm. Cramp & Sons Co	....	....	....	....
13	Wm. Cramp & Sons Co	....	....	....	....
Miscellaneous					
Fuel Ship No. 16	Brazos, Boston Navy Yard	83.0	82.	76.5	75.
Fuel Ship No. 17	Brazos, Boston Navy Yard	0.0	0.	0.	0.
Fuel Ship No. 18	Brazos, Boston Navy Yard	0.0	0.	0.	0.
Gunboat No. 21	Asheville, Charleston Navy Yard	91.	85.	90.	84.
Gunboat No. 22	Asheville, Charleston Navy Yard	0.	0.	0.	0.
Hospital Ship No. 1	Philadelphia Navy Yard	24.	9.	24.	9.
Ammunition Ship No. 1	Puget Sound Navy Yard	60.	52.	53.	41.
Ammunition Ship No. 2	Puget Sound Navy Yard	8.	0.	6.5	0.

NOTE: Above percentages of completion pertain only to work in connection with hulls and fittings; no machinery is included.

There are 229 destroyers, 77 submarines, 31 mine sweepers, 19 seagoing tugs, 40 harbor tugs and 52 Ford boats (*Eagle* class) in various stages of completion.

NAVAL STRENGTH IN 1920.—Rear Admiral Taylor, Chief of Naval Construction, told the House Naval Affairs Committee that when the 1916 program of construction and the program laid down during the war have been completed, the navy will have over twice the number of ships it had before the outbreak of the war, this being exclusive of 350 wooden submarine chasers, which the navy expects to sell or put out of commission. Destroyers represent the backbone of the increase. Of these we have 100 in commission, and 240 more will be added in the next 18 months. By July, 1920, the total number of vessels will be over seven hundred.—*Scientific American*, 21/12.

THE AMERICAN DESTROYER.—By far the most important part of our wartime program was that which called for the immediate construction of a large fleet of destroyers.

The majority of these, in fact, all of the vessels built since the war commenced and now under contract, are of the new 1200-ton type. The water line length is about 320 feet, the beam about 32 feet, with a draft of between 10 and 11 feet, according to load. As compared with our earlier 750-ton destroyers of the *Nicholson* class, this represents an increase of about 400 tons displacement, and the speed has been raised from about 30 to 35 knots. They are driven by turbines through mechanical reduction gear, and we understand that in service these boats have easily made 35 knots speed or more and that the motive power has proved to be thoroughly reliable.

The most notable feature in a first view of these vessels is the disappearance of the separate fo'c'sle deck with a break aft of the bridge to the level of the main deck, and the substitution of a flush deck from stem to stern. There is the same high freeboard forward as in the early destroyers—in fact, the freeboard is considerably greater, and of course the average freeboard of these vessels is several feet in excess of that of the old type. There is also, due to this construction, a considerable increase in strength, since the girder depth of these boats, and consequently their ability to resist bending stresses, is greatly increased for similar weights of material. The experience had with them in the stormy waters of the eastern Atlantic has shown that they are very strong and exceedingly able craft.

The armament consists of four long 4-inch rifles, one on the foc's'le deck, one aft, and two carried on a raised structure somewhat forward of amidships. In the early boats these two guns were carried on the beam at the break of the fore deck, and the lifting of them from the main deck to the level of the fo'c'sle deck, that is, through a height of seven to eight feet, gets them out of the way of broken water and gives them a much better command at all times.

The armament of a destroyer to-day is vastly different from that of prewar times, for, in addition to guns and torpedoes, it includes the terribly destructive depth bomb. These are carried on sloping run-ways at the stern. When an attack is made they are released, one by one, and fuses are set so that the detonation shall take place as near to the estimated position of the U-boat as possible.—*Scientific American*, 28/12.

POLICY

NAVY STATIONS ABROAD TO BE KEPT UP A YEAR.—American naval stations will be maintained for at least a year at Brest, Gibraltar, and in the Azores to render aid to American merchant ships. The consent of France, England, and Portugal has already been obtained. The aero and radio stations at these points will be in readiness to respond to calls for aid by American shipping in distress, and facilities will be afforded for needed repairs and supplies.

The other naval establishments in Europe have been ordered abandoned as rapidly as possible, and progress in this direction has already been con-

siderable. The United States Navy had 27 aero stations along the European coast, the material of which, except at Brest, Gibraltar, and the Azores, is being shipped home. Naval transports, relieved of carrying munitions, will hereafter convey food supplies.—*N. Y. Times*, 19/12.

To Have Fewer Changes of U. S. Fleet Officers.—Secretary Daniels is planning a reorganization of naval practice to stop the frequent changes of officers aboard the ships of the fleet, which have been the rule during the war. Commanders of the big ships have objected to having their ships' companies constantly broken up. The Secretary said to-day that immediately after the naval review in New York harbor next week he expected to have conferences on the subject with Admiral Mayo, commanding the Atlantic fleet, and Rear Admiral Blue, the new chief of the Bureau of Navigation.—*Wash. Evening Star*, 22/12.

Navy to Comprise Two Great Fleets.—*One for Pacific and Other for Atlantic Coast to War in Summer Maneuvers.*—To keep the navy "fit and on its toes," two great fleets, one based on the Pacific Coast and the other on the Atlantic Coast, will be established by next summer with war games and joint maneuvers as a part of a regular program of training.

Secretary Daniels, in explaining his plans to the House Naval Committee to-day, said that after every war there was a tendency for the navy to retrograde, and that the fleet division had been determined upon to prevent any slump. The plan, he said, had received the "enthusiastic indorsement" of Admiral William S. Benson, Chief of Operations, now in Europe with the peace delegation.

"An admiral who can stay long enough to stir up ambition" will be placed in command of each fleet, Mr. Daniels said, and all officers will be kept on their ships for two years. In effect, the Secretary added, there will be a war between the Atlantic and Pacific fleets, "which will so stimulate keenness that it will make the men feel they are in actual war."

Mr. Daniels did not indicate to the committee how many ships would be in each fleet. It is assumed, however, that there will be an equal distribution of the capital ships, most of which heretofore have been kept on the Atlantic Coast. During joint maneuvers the combined fleet will visit each coast, so as to give the people on the Atlantic and Pacific seaboards an opportunity to see the full naval force.

Mr. Daniels also told the committee that during peace times the submarine bases at San Diego, Cal., Key West, Fla., and New London, Conn., and the air defence stations at San Diego and Pensacola, Fla., will be retained.

The principal training stations for seamen in the east will be in Chicago, Hampton Roads, and Newport, R. I.—*N. Y. Times*, 1/1.

Matériel

Bureau of Yards and Docks Has Busy Year.—The annual report of the Bureau of Yards and Docks shows that for the fiscal year 1918, there was an expenditure in this department of $193,164,458. Three drydocks, at Norfolk, Pearl Harbor and Charleston, have been under construction, shipbuilding facilities were installed or improved at New York, Philadelphia, Norfolk, Charleston, Mare Island and Puget Sound.

Camps were erected for 168,875 men at a cost of $45,437,000. A naval aircraft factory was contracted for, and emergency hospitals were erected in many places. Six hundred and eighty-two contracts were executed during the year, while seven hundred and thirty-five were let, involving $84,700,000.—*Naval Monthly*, January.

Personnel

For Year's Naval Force of 225,000.—*House Committee Fixes Number Effective From July 1. No Permanent Provision.*—A temporary naval force of 225,000 enlisted men for the year beginning next July was decided

on to-day by the House Naval Subcommittee, in beginning the work of framing the naval appropriation bill. This force is 25,000 less than was recommended by Secretary Daniels.

No provision will be made in the bill, the committee decided, for increasing the permanent strength of the navy, now fixed at 142,000 men. This decision was in accord with Secretary Daniels' recommendations that permanent increase should await a study of ship complements that is to be made during the summer by the naval officials.

Indicates Retrenchment.—However, the committee's action in adopting a plan calling for fewer men than recommended by the Secretary was regarded as indicating that the committee plans reduction of department estimates for the year. Committee members pointed out that appropriations depend more or less on the personnel.

The permanent force of the navy, it is expected by the committee, will rate the strictly naval craft, with 20,000 men of the temporary force being used for the army transport service and the remainder for manning shipping board vessels.

In deciding on the personnel force, committee members regarded a complement of 1000 men, exclusive of officers, as sufficient for the dreadnoughts and battle cruisers for peace time, this being a reduction from the basis of 1200 to 1400 men. The committee also discussed placing in service a part of the destroyers and 110-foot submarine chasers, now in the navy, as also some of the *Eagle* patrol boats that are being built.—*Washington Evening Star,* 10/1.

OPERATIONS

SEEK TEUTON SHIPS TO BRING OUR TROOPS.—*America and Britain to Give Food to Austria and Germany in Return.*—American and British representatives will hold a conference with German Admiralty authorities at Treves, Wednesday, to acquire possession of German and Austrian passenger ships for the transportation of troops. The United States will be represented by E. N. Hurley, Chairman of the Shipping Board, and Admiral W. S. Benson. Admiral Brown, will represent Great Britain.

It is proposed that America give Austria and Germany food in return for the ships. It is planned that the British will get smaller ships for the return of troops to Australia and Canada, while America will have the big boats, which will include virtually all the Hamburg-American liners, including the *Imperator.* This division is suggested because the bigger liners are too large for Australian or Canadian harbors.

If this arrangement becomes effective, it will increase the flow of troops to America about 70,000 per month. This will make a total capacity of shipping approximately 170,000 men each month.—*N. Y. Times,* 14/1.

MERCHANT MARINE

WORLD'S NEW VESSEL CONSTRUCTION.—*U. S. Building More Ships Than all Other Countries Combined.*—Merchant vessels under construction throughout the world at the end of September aggregated 6,371,388 gross tons. This includes 1966 steam vessels of 6,258,194 tons and 178 sailing vessels of 113,194 tons. The figures are furnished by Lloyd's Register of Shipping for the quarter ended September 30.—*Nautical Gazette,* 4/1.

AMERICAN SHIPS GO BACK TO OWNERS.—*Government Will Retain Only Those Now Engaged in Army Service.*—All American ships which have been requisitioned by the government during the war have been released to their owners, with the exception of those engaged in army service, it was announced yesterday by the United States Shipping Board. In the place of those retained for service and which are fitted for the transportation of troops, the owners will receive an equal tonnage of government built and owned vessels. A. E. Clegg, Assistant Director of Operations, said that all the ships referred to now in American ports would be turned over to their owners at once; those on voyages would be released on their return to the United States.

TABLE SHOWING TOTAL OF UNITED STATES TROOPS TRANSPORTED AND THE SHIPS THAT CARRIED THEM

Prepared by Ensign Walter Logan, U. S. N., Statistical Officer, Cruiser and Transport Force, United States Atlantic Fleet

	Carried by United States naval transports	Number of United States naval transports sailed	Carried by British ships	Number of British ships sailed	Carried by British-leased Italian ships	Number of British-leased Italian ships sailed	Carried by other United States ships	Number of other United States ships sailed	Carried by other ships (French, Italian, &c.)	Number of other ships sailed (French, Italian, &c.)	Total United States troops transported	Total ships sailed
1917												
May	1,035	3	508	2	0	0	0	0	0	0	1,543	5
June	8,855	9	1,080	1	0	0	5,156	8	0	0	15,091	18
July	5,281	8	7,299	6	0	0	0	0	296	1	12,876	15
Aug.	4,310	6	11,890	7	0	0	1,109	2	2,094	2	19,403	17
Sept.	13,917	15	19,671	12	0	0	0	0	0	0	33,588	27
Oct.	25,098	14	13,013	9	0	0	0	0	1,916	1	40,027	24
Nov.	9,988	9	10,669	7	0	0	1,235	2	1,830	1	23,722	19
Dec.	37,445	16	11,370	9	0	0	0	0	0	0	48,815	25
1918												
Jan.	25,662	16	20,514	9	0	0	0	0	1,879	1	48,055	26
Feb.	39,977	17	9,259	4	0	0	0	0	3	1	49,239	22
Mar.	56,278	26	27,626	14	0	0	1	1	1,895	4	85,710	45
April	67,553	27	47,362	20	2,626	2	737	11	1,794	3	120,072	63
May	96,273	33	133,795	75	12,127	6	3,288	22	2,231	5	247,714	141
June	115,256	36	140,172	70	14,465	7	6,003	11	4,538	4	280,434	128
July	108,445	33	175,526	89	11,502	7	4,020	13	11,866	5	311,359	147
Aug.	116,401	36	137,745	74	9,376	6	8,495	15	14,358	9	286,375	140
Sept.	107,025	35	134,576	69	7,052	4	5,511	18	5,506	3	259,670	129
Oct.	72,092	43	94,214	57	11,098	7	4,709	17	1,950	3	184,063	127
To Nov. 11.	1,191	9	10,698	12	0	0	235	3	0	0	12,124	24
Total	912,082	391	1,006,987	546	68,246	39	40,499	123	52,066	43	2,079,880	1,142

	Percentage carried by United States naval transports	Percentage carried by British ships	Percentage carried by British-leased Italian ships	Percentage carried by other United States ships	Percentage carried by other ships	Under United States naval escort	Under British naval escort	Under French naval escort	Percentage under United States naval escort	Percentage under British naval escort	Percentage under French naval escort
1917											
May	67	33	0	0	0	258	1,285	0	17	83	0
June	59	6½	0	34½	0	15,032	59	0	99	1	0
July	41	57	0	0	2	10,063	2,566	247	78½	20	1½
Aug.	22	61	0	6	11	12,259	4,129	3,015	63	21	16
Sept.	41	59	0	0	0	17,432	12,898	3,258	51½	39	9½
Oct.	62½	32½	0	0	5	36,893	3,134	0	92¼	7¾	0
Nov.	41½	46	0	4½	8¼	13,246	10,476	0	56¼	43¾	0
Dec.	77	23	0	0	0	42,783	6,032	0	87½	12½	0
1918											
Jan.	53	42½	0	0	4½	35,827	12,228	0	75	25	0
Feb.	81½	18½	0	0	0	48,795	444	0	99	1	0
Mar.	65	33	0	0	2	73,095	12,615	0	85	15	0
April	56	39½	2	1	1½	91,308	28,764	0	75½	24½	0
May	39	53½	5	1½	1	220,463	26,652	599	88½	11	½
June	41¼	50	5	2¼	1½	244,631	30,912	4,891	87½	11	1½
July	35	56½	3½	1	4	258,332	46,329	6,698	83	15	2
Aug.	41	48	3	3	5	237,920	22,572	25,883	83	8	9
Sept.	41	52	3	2	2	224,298	20,681	14,691	86	8	6
Oct.	39	51	6	3	1	130,274	51,454	2,335	70½	28½	1
To Nov. 11.	10	88	0	2	0	7,451	4,673	0	61½	38½	0
Total	43¾	48¼	3	2½	2½	1,720,360	297,903	61,617	82¾	14¼	3

In addition to the return of requisitioned ships to their owners and replacement of vessels in government service, 34 ships of 275,194 deadweight tons, owned by the Shipping Board were to-day allotted to various lines by the board. A report showed that on January 9 there were under requisition 248 American ships, of a total of 1,219,283 gross tons. Of these possibly 75 are in the service of the War Department as troop and supply ships.

The total number of ships owned by the board is 636, of 2,348,250 gross tons, of which 534, of 1,994,913 tons, are new vessels; 59, of 257,962 tons, are former German ships; 6, of 24,417 tons, former Austrian ships, while 37, of 100,962 tons, are former Great Lakes ships.—*N. Y. Times*, 17/1.

U. S. SHIPBUILDING OUTPUT FOR 1918.—American shipyards built 1882 vessels of 2,721,281 gross tons in 1918. Reports of the Bureau of Navigation of the Commerce Department show this total, of which all but 124,000 tons represented seagoing ships, the seagoing steel tonnage alone aggregating 1,861,321 gross tons. The bureau's figures for 1917 construction show that 1,034,000 gross tons were constructed by American shipyards.

The armistice brought about a decided setback in the yards' output. November was the month of greatest construction in the history of American shipbuilding, 171 vessels of 357,660 gross tons of seagoing ships being produced. In December only 153 ships were completed and the tonnage amounted to 283,359.—*Nautical Gazette*, 11/1.

REMOVING GUNS AND GUN PLATFORMS FROM AMERICAN MERCHANT VESSELS.—The United States Shipping Board issues the following:

Guns and gun platforms are being removed from American merchant ships in overseas trade as rapidly as they arrive at home ports, the United States Shipping Board announces.

On vessels operated by the board the gun emplacements, usually heavy steel platforms on high supports at bow and stern, are being cut away and dumped on the dock without ceremony.

With the removal of guns the gun crews carried during the submarine war go back to their naval duties.

Changes Considered Important.—The changes thus effected are considered by the Shipping Board an important factor in the work of manning the merchant marine on a basis demanded by peace conditions. During the progress of the war living conditions on merchant vessels were abnormal, owing to congestion. Vessels carrying 12 merchant sailors in their deck force often had naval gun crews of 15 men. These occupied the regular crews' quarters, which the merchant sailors cheerfully gave up, accepting such emergency quarters as could be provided for them.

The Shipping Board is now returning the crews on its vessels to the kind of quarters they were accustomed to occupy before the war, although the forecastle is now toward the stern instead of at the bow of the ship. Danger from mines prompted the change originally, and the arrangement was found so satisfactory that it will be retained.

With proper berth space again available, the Shipping Board plans to use the merchant ships in a broad program for the training of the additional personnel that will be required for new vessels now coming out.

Spare room in the quarters now being vacated by gun crews and elsewhere will be set aside by the Shipping Board, on each of the vessels which it operates, for the accommodation of apprentices, and for four junior deck officers and four junior engineer officers. The latter will be carried in addition to the usual number of officers on the ship, for purposes of special training, following technical instruction ashore at the board's free engineering and navigation schools. It is expected that the new arrangement will absorb a present surplus of junior officers that has resulted from the work of these schools, which have graduated 6799 navigating officers and engineers since this country entered the war.

Three Months' Sea Training.—Three months' training at sea will be the maximum given a junior officer before he receives his license, and is shipped on another vessel as a regular officer. He will not be a "green hand" when he begins his training, as only experienced men are trained at the board's schools.

Apprentices for the merchant ships will be taken from the board's training ships, and will be trained as part of crews on merchant vessels, in the duties of ordinary seamen, firemen, messmen, or cooks.—*Official Bulletin*, 6/1.

DISCONTINUANCE OF NAVAL REGULATION OF UNITED STATES MERCHANT SHIPS.—The U. S. Shipping Board have authorized the following statement, relative to the discontinuance of naval regulation of merchant ships. At the same time intimation is given of their intention to hereafter man all merchant ships with merchant sailors:

"The Shipping Board announce through its acting chairman, that, in consequence of the elimination of the submarine danger, with the attendant discontinuance of the convoy and other naval regulations which governed the movements of cargo vessels during the war emergency, it has been decided to man all out-coming vessels, excepting for the present, those steamers engaged in the transport of troops, with merchant sailors.

"In making this decision the board has been guided by the necessity of restoring the usual commercial conditions governing the operation of merchant vessels, as rapidly as possible, in order to enable the ordinary competitive conditions to be met. During the war, it was for military reasons considered proper that many of the vessels should be under naval regulations as they were so peculiarly but instruments of our military operations in Europe, and the splendid service rendered by the officers and men of the naval reserve force in this service is fully recognized. There have also been operated through the submarine and mine infested waters, many merchant vessels manned by the usual merchant crews. The board is fully conscious of the great service rendered by these men in a most difficult and dangerous trade, and desires to publicly express its appreciation of the part played by the merchant sailor in winning the war."—*Shipping*, 4/1.

CREW PLACING FOR SHIPPING BOARD CRAFT.—The U. S. Shipping Board on December 24, announced that beginning with the New Year, crews for all merchant vessels operated by the board will be placed in employment through a central agency to be known as the Sea Service Bureau of the U. S. Shipping Board. This agency will have offices in principal American ports, and through it not only seamen but masters, mates and engineers—in fact, the proverbial "all hands and the cook,"—will be signed on for sea duty—*Shipping*, 4/1.

ONE HUNDRED AND FORTY-FIVE MERCHANT SHIPS LOST BY U. S. IN WAR.—Loss of 145 American passenger and merchant vessels of 254,449 tons and 775 lives through acts of the enemy during the period from the beginning of the world war to the cessation of hostilities, November 11, is shown by figures made public recently by the Department of Commerce's Bureau of Navigation.

The report does not include several vessels, the loss of which has not been established, as due to acts of the enemy.

Nineteen vessels and 67 lives were lost through use of torpedoes, mines and gunfire prior to the entrance of the United States into the war.—*Naval Monthly*, December.

NEW WAGE SCALE FOR STEAMSHIP OFFICERS.—New wage scales for licensed officers of all steamships plying from Atlantic and Gulf ports have been promulgated by the Shipping Board, effective from January 1 to May 1. They are based on the size of the vessels, which are divided into five classes.

are the same as the present rate paid in the coastwise traffic and do not contemplate the payment of bonuses in any form whatever.

Masters will receive from \$300 to \$375 a month, depending on the size of the ship; chief engineers, from \$212.50 to \$287.50; first officers and first assistant engineers, \$181.25 to \$206.25; second officers and second assistant engineers, \$162.50 to \$187.50; third officers and third assistant engineers, \$143.75 to \$168.75; fourth officers and fourth assistant engineers, \$143.75 to \$150, and junior engineers, \$125.

"Wage increases which might have been favorably considered during conditions of warfare would not now be warranted, owing to the unsettled conditions following cessation of hostilities," said the award. It was added, however, that as there was no immediate prospect of reduction in the cost of living the present rate of pay in the coastwise service should not be diminished, but should be made universal for all services from Atlantic and Gulf ports, including West Indian, South American and transatlantic services.

The new scale is mandatory on all vessels owned or under requisition by the Shipping Board. A difference of opinion, however, was said to have arisen among members of the commission making the award as to the extent to which the award should be mandatory on other American vessels, inasmuch as the armistice was signed after the agreement for the arbitration of the wage scale was made. Owing to the continued pressing national necessity in relation to shipping, however, the board urged that all private owners and operators of vessels not requisitioned should pay the scale voluntarily to promote stability of conditions and prevent interruption of traffic.—*Nautical Gazette*, 4/1.

OFFICE OF SUPERCARGO REVIVED.—The Division of Operations of the U. S. Shipping Board is at present engaged in organizing a force of men who will be its personal representatives and therefore accredited officers of the government on board government owned merchant vessels. The Shipping Board has revived for these men the ancient and honorable title in the American merchant service of "Supercargo." It will be the duty of these officers to make direct report to the Division of Operations regarding the performance of the ship on each voyage, the handling of the cargo, and in general all other matters in which the Division of Operations as representing the owners of the ship may be expected to have an interest. To fill this important and responsible position the Division of Operations needs alert, ambitious and intelligent young men of good character. A certain amount of sea experience and training, and knowledge of the steamship business and overseas commerce in general, is desirable although not essential. In return for this the Shipping Board offers an initial salary of \$175 per month in addition to subsistence. Mr. George Eggers, Chief of the Bureau of Accounting Personnel, Division of Operations, of the U. S. Shipping Board in Washington, has been placed in charge of the selection of men for these posts.—*Army and Navy Journal*, 11/1.

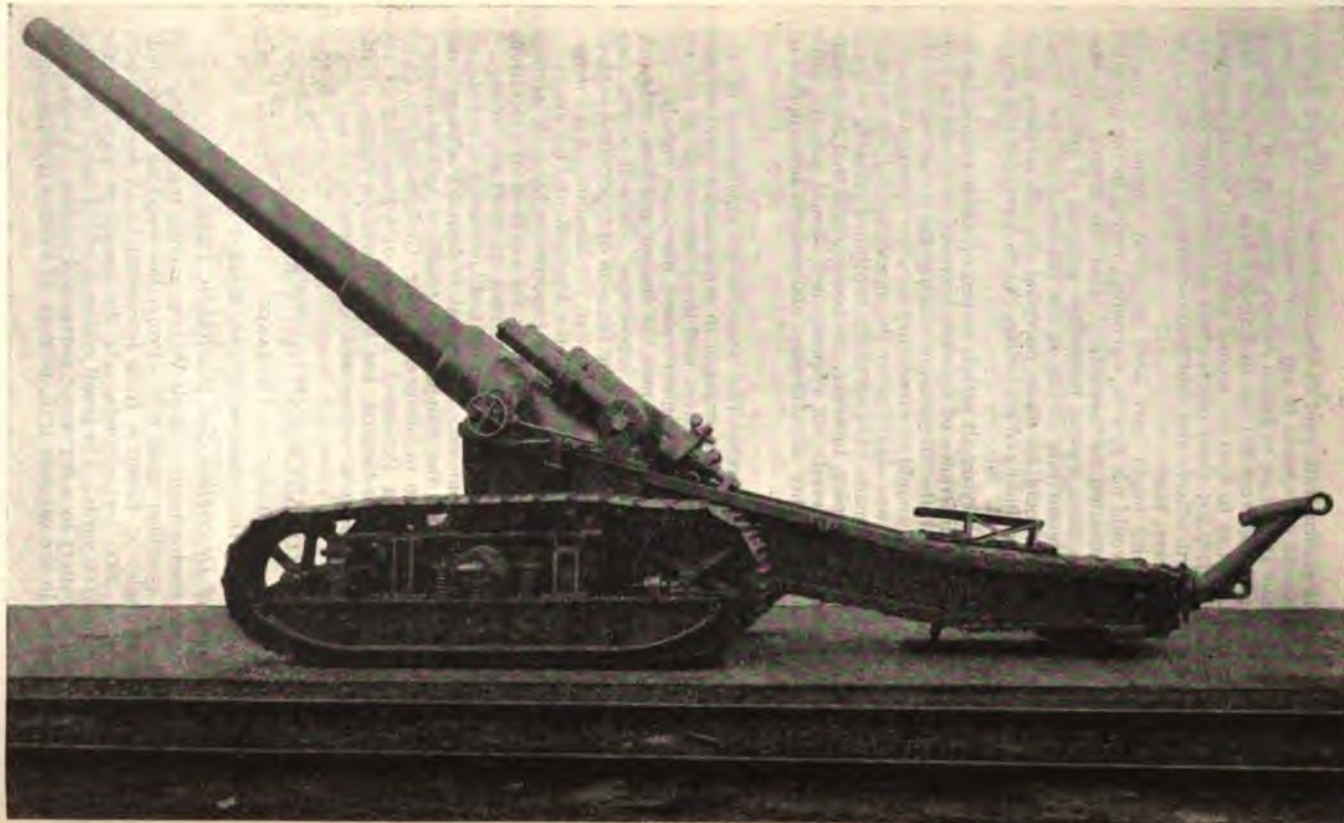
ORDNANCE AND GUNNERY

BUREAU OF ORDNANCE

SEVEN-INCH TRACTOR MOUNT, MARK V

General Description, See Illustration, Page 278

1. The 7" naval tractor mount, Mark V, is a mobile, track-laying field piece bearing a 7", 45-caliber naval rifle. Projectiles weighing 153 pounds may be fired at angles of elevation from horizontal to 40 degrees, with muzzle velocity of 2800 foot seconds. At the maximum elevation the extreme range is 25,000 yards. The recoil system is of the liquid type; the gun is returned to battery by a pneumatic countercoil system. A traversing gear, incorporated in the carriage trail, permits of limited training either



SEVEN-INCH NAVAL TRACTOR MOUNT, MARK V.

side of the center line. When a greater range of training is desired, the mount is either shifted on the ground or is mounted upon a firing platform which provides for training through a firing angle of 60 degrees. The track layer, which is of the double-tread caterpillar type, is designed to carry the mount over practically any kind of ground likely to be encountered in service. The proportions of the chain tracks are such as to produce a pressure of about 12 pounds per square inch upon the soil during transportation, which is approximately half that exerted by a horse.

2. The track layer also serves as a stand or foundation for the mount during action. A 120 h. p. gas-engine driven caterpillar tractor is used to draw the mount from one position to another. A limber hooked between the mount and the tractor supports the trail during transit. During action the limber and the tractor are withdrawn from the immediate field of danger. A shell loading tray, which rests on the carriage trail, is used to load shells into the breech.

GUNS MADE DURING WAR.—During the 20 months from the date of the entry of the United States into the war to last December 1, 2841 guns of medium caliber were manufactured under the direction of the Naval Bureau of Ordnance at gun-manufacturing plants, Secretary Daniels told the committee. Of this number, 1887 were placed in actual service against the enemy.

Secretary Daniels explained that the total number of 2841 did not include guns that were on hand and in reserve on April 5, 1917, nor those of a larger caliber than five inches. The great majority were manufactured in plants placed in operation since the beginning of the war, he said, and every one was complete with mounts, sights and all accessories.

When hostilities ceased 5-inch guns were being delivered at the rate of 30 a month, 4-inch guns at the rate of 70 a month and 3-inch guns at the rate of 100 a month. During the 20 days after the signing of the armistice 805 guns were delivered to the navy.—*Washington Evening Star*, 2/1.

COMPARATIVE CHART ON THE PRODUCTION OF RIFLES, MACHINE GUNS, AMMUNITION BY U. S., GREAT BRITAIN, AND FRANCE.—The War Department authorizes the following from the Statistics Branch, General Staff:

The following is a comparative chart on production in France, Great Britain, and the United States on rifles, machine guns, and ammunition, the source of this information being the Ordnance Department, Interallied Bureau of Statistics:

AVERAGE MONTHLY RATE, JULY, AUGUST, AND SEPTEMBER, 1918

Machine guns and machine rifles:	
Great Britain	10,947
France	12,126
United States	27,270
Rifles:	
Great Britain	112,821
France	40,522
United States	233,562
Rifle and machine gun ammunition:	
Great Britain	259,769,000
France	139,845,000
United States	277,894,000

TOTAL PRODUCTION APRIL 6, 1917, TO NOVEMBER 11, 1918

ıine guns and machine rifles:	
Great Britain	181,404
France	229,238
United States	181,662

Rifles:	
Great Britain	1,971,764
France	1,416,056
United States	2,506,742
Rifle and machine gun ammunition:	
Great Britain	3,486,127,000
France	2,983,675,000
United States	2,879,148,000

British and French production for October and the first part of November was estimated at the same rate as the preceding three months. Ammunition figures for the United States include ball cartridges cal. 30, and 8 mm. of service, incendiary, armor-piercing, and tracer types. Since the need for the original equipment of troops no longer existed, French and British production of rifles during 1918 was at a lower rate than had previously been attained.—*U. S. Bulletin*, 15/1.

In his annual report to the Secretary of War Maj. Gen. F. W. Coe, Chief of Coast Artillery, says that a gun of 24-inch caliber to shoot 40 miles is among the near possibilities. On other matters the report says:

In order that the general trend of development in heavy artillery may be studied and applied properly to seacoast defence, it is desirable to state the general features of this development and to suggest the principles which appear to underlie their application.

Gun Power.—This has increased both in range and the caliber of the gun. Guns of 24-inch, ranging to 40 miles, may be realized, while longer ranges for special types are possible if desired.

Mobility.—Guns of the largest caliber are transported on their firing carriages by rail. The calibers of tractor-drawn matériel have increased materially, and it is unlikely that the limits have yet been reached.

Aeroplane Bombardment.—Although this is not a strictly artillery development it should be considered in connection with the effects of artillery fire inasmuch as the aeroplane may be regarded as taking up these effects at the longer ranges and projecting them far back into enemy territory.—*Official Bulletin*, 17/12.

NAVIGATION AND RADIO

NAVAL CONTROL OF WIRELESS.—The Navy Department has purchased all of the radio stations except four high-power stations of the Marconi Wireless Telegraph Company of America. The stations sold by the company are 45 in number, of which 19 are on the Atlantic and Gulf coasts, 16 on the Great Lakes and 10 on the Pacific Coast. The Navy Department has purchased from the Alien Property Custodian the radio station at Sayville, L. I., formerly controlled by German interests and intended for transatlantic wireless traffic.—*Scientific American*, 11/1.

The report of the United States Hydrographer, Rear Admiral Seaton Schroeder, United States Navy, retired, on the operations of the Hydrographic Office during the fiscal year says, in part:

The Hydrographic Office continued to supply charts and sailing directions as needed for the navy and other public services, and the mercantile marine. An increasing demand has also been met for manuals of instruction in navigation called for by various schools and colleges maintaining navigation classes, and by young reserve men and others aspiring to become officers in the navy or the mercantile marine.

Independent of Other Nations.—It has long been recognized by all who have had opportunity to observe the working of this office from within, or to use its products, that it should be brought to a position of independence of foreign sources for maintaining its supply of charts and sailing directions

for not only vessels of the navy but for other public services and for vessels of the mercantile marine. Before the present European war had progressed many months it had become evident that what had been a desideratum was fast becoming a necessity, as foreign sources for such vital material were being very greatly curtailed or wholly closed. Our entry into the war made it an absolute *sine qua non;* and, although the final result can not be immediately achieved of covering the more remote untraveled seas with our charts and sailing directions, the office has been definitely brought to a position of virtual independence and self-support.—*Official Bulletin.* 28/12.

ENGINEERING

THE "EAGLE" BOATS.—The design of the *Eagle* boats was worked out at the Highland Park plant of the Ford Motor Company under the direction of naval officers. Admiral D. W. Taylor and Captain Robert Stocker planned the hull with the aim of eliminating curved sections as much as possible. Straight lines characterize the design throughout to a startling degree. The boilers and turbine were designed by direction of Admirals Griffin and Dyson and Commander S. M. Robinson. The Ljungstrom turbine with planetary reducing gear was used with success. Hull manufacturing methods were worked out under the supervision of Mr. Charles C. West of the Manitowoc Shipbuilding Company, and Commander Carlos Bean of the navy was appointed executive in charge of the development of the power plant.

The Ljungstrom steam turbine is peculiarly suited for destroyer service as its efficiency is high at full loads; the steam consumption is about nine pounds per horsepower at full load and only twelve pounds at one-fourth load. The design eliminates noise and vibration in the turbine itself almost completely, which is highly important. The reducing gear tends to magnify turbine vibration and noise and if these are absent the gear alone will not be noisy when properly cut and mounted. Noise and vibration cannot be tolerated in a naval vessel of the destroyer class.

On account of the scarcity of special ship steel shapes and the unavoidable delay in getting them, flanged plates and structural angles were used instead. The flanged plates could be rapidly fabricated from plate stock, and while the distribution of metal and consequent physical properties are inferior to those of regular rolled shapes the difference is not of serious importance. Flanged plates have the advantage over rolled shapes that they can be made to any dimension required and choice is not limited to the regular mill patterns.

The strakes, angles, frames and gussets were drawn up and the positions of all rivet holes were laid out. No detail was omitted that would hamper manufacturing if left to be laid out in the shop. A pattern boat was built in the Highland Park plant and after some changes had been made it was taken apart and each piece marked with its symbol which defined its place and identified it with the drawing. While the planning, drafting, building of the model and its dissection were under way, the new organization that had been formed at the plant on the River Rouge near Detroit, had already begun to manufacture hulls.

Power Plant of the Eagle.—The turbines and boilers were built at Highland Park and the auxiliaries were purchased from the makers. The boilers, two in number, are of the Stirling water tube type, rated at 1250 h. p. each. They are fired with oil, there being three burners in each furnace. The turbine runs at 5000 r. p. m. and develops 2500 h. p. with saturated steam at 350 pounds pressure. Brake tests showed it to have a power exactly 40 per cent in excess of its rating, or 3500 h. p. The shaft bearings are of the floating type and the speed is reduced by a 10 to 1 ratio planetary gear between the turbine and the propeller shaft, the propeller running at 500 r. p. m. The official speed test developed 19½ knots but 21 to 22 knots were made unofficially.

Although the *Eagles* are small, high-power boats in which every cubic inch of space is at a premium, the equipment and appointments are as complete in their way as those of a battleship or cruiser. Provision is made for using either fresh or salt water, which means duplication of pipe systems and auxiliaries. An idea of the amount of piping crowded into them may be gained from the statement that there are 37 distinct pipe systems.

FORD BOAT. ("EAGLE" CLASS).

The installations of this maze of pipes is difficult in a large vessel and is doubly so in the limited space available here. The thin brass voice tubes three inches in diameter have to be made in many sections and bent to follow a most devious course to connect the stations. Every valve, cock, pump, door, ladder and apparatus is marked with a brass name plate. This seemingly small detail is by no means insignificant in the total, as there are over 3600 nameplates in all.

Seven cabins and the quarters provide for officers and crew of 67. The captain's cabin, though small, has a toilet, clothes locker and complete equipment. Appointments were designed to promote the comfort and health of the men, in marked contrast to the British destroyers which provide only the absolute necessities.

A FORD "EAGLE."

BUILDING AND LAUNCHING SHIPS ON WHEELS.

The armament consists of two 4-inch and one 3-inch rapid fire guns, a Y-gun for firing "ash cans" or depth bombs and depth bomb droppers.
Note: The official speed test developed 18.32 knots. Article from Ford Methods in *Ship Manufacture*, by Fred E. Rogers on Industrial Management for January. Illustrations from other sources.

BIG U. S. WARSHIPS TO LEAD WORLD'S.—*Secretary Daniels Tells House Committee of Electrically Driven Craft—New Mexico Speedy.*—America's capital fighting ships of the future will be superior to those of other nations because of their electrically driven machinery, Secretary Daniels told the House Naval Committee to-day in disclosing remarkable results attained by the new dreadnought *New Mexico,* equipped with the electric drive which is to be a feature of all the big ships authorized since 1916.

The *New Mexico's* turbo-electric machinery was designed to develop 26,500 horsepower at full speed and to give the ship a speed of 21 knots.

"She actually developed more than 31,000 horsepower," Mr Daniels said, "and maintained for 4 hours a speed of 21¼ knots, and this when running at a displacement 1000 tons greater than her design called for.

"If she had been tried at her designed displacement, as is customary with all new ships, she would have made 21.5 knots without any trouble whatever; and, what is still better, she could have kept up this speed as long as her fuel lasted, for, like all our later dreadnoughts, she is an oil burner and there would be no reduction in speed due to the necessity of clearing fires, which must be done in coal-burning ships after a run of four hours at top speed."

The Secretary said fuel economy at cruising speed had been one of the things sought in substituting electric drive for the ordinary turbine equipment.

"And I am happy to say," he added, "that this requirement also was met. As a matter of fact, the *New Mexico* will steam at 10 knots on about 25 per cent less fuel than the best turbine driven ship that preceded her.

"On the whole, I think the country has cause to be proud of this achievement in engineering, not alone because of the pronounced success in this particular instance, but because of the assurance it gives of the superiority of our capital ships to those of foreign nations."

The advantages of electrical propulsion as applied to battleships are, the official said:

1. A quick shift by merely turning a switch from cruising speed of 12 knots an hour to high speed of 21 knots an hour.
2. Economy in fuel.
3. The practicability of running a ship astern with exactly the same speed.
4. Saving of space in the engine room.
5. Making it possible to place different units in watertight compartments so that a torpedo explosion disabling one part of the machinery would not cripple the ship.

Members of the Naval Affairs Committee were enthusiastic over the proved practicability and efficiency of electrical propulsion. Secretary Daniels testified that it was much cheaper to equip a vessel with electrical driving machinery than with turbine engines.—*N. Y. Times.*

THE MARINE OIL ENGINE IN THE UNITED STATES.—The types of engines being fitted include semi-Diesel engines, both two and four-cycle, direct reversing and with reverse gears, Diesel engines, two and four-cycle, land trunk piston and marine crosshead designs, engines of high speed of revolution with mechanical gearing, or electrical reduction between the engine and the propeller, and the usual slow-speed direct-coupled motors. The powers up to which the marine oil engine is being built at present in America are relatively small, 200 h. p. per cylinder being the maximum of which we have record. The many and varied types of machinery, however, which are now at sea in the American marine, or shortly will be tried out, will give to the American marine engineers a very clear insight into the problems associated with the future developments of this industry, and will provide much useful data on which to base future designs.—*Engineering,* 29/11.

AERONAUTICS

NAVY DIRIGIBLE HAS FLIGHT.—Manned by aviation officers of the marine corps and the navy, and with two civilian mechanics aboard, the first of the navy's twin-motor dirigibles flew over Washington, October 22, at the completion of the first lap of approximately 315 miles of a flight from Akron, Ohio, to Rockaway, N. Y.

The big dirigible landed at the Anacostia aviation field for a fresh supply of fuel, but resumed its flight at 1.17 p. m. The start was made from Akron, October 22, at 1.10 a. m., central time, and the landing was made at 11.10, eastern time, a running time of nine hours, approximately 35 miles an hour.—*Naval Monthly*, 18/12.

OUR WAR IN THE AIR.—When hostilities were suspended American aviators had destroyed 661 more German airplanes and 35 more German balloons than the Americans had lost. The number of enemy airplanes destroyed by the Americans was 926, and the number of balloons 73, continues a recent Associated Press dispatch. Two hundred and sixty-five American airplanes and 38 balloons were destroyed by the enemy. On November 11, the day of the signing of the armistice, there were actually engaged on the front 740 American airplanes, 744 pilots, 457 observers, and 23 aerial gunners. Of the machines, 329 were of the pursuit type, 296 were for observation and 115 were bombers. Between September 12 and November 11 the air forces operating with the First Army dropped about 120 tons of high explosive on the enemy lines and supply depots and railheads. Figures concerning America's share on other parts of the front have not yet been divulged.—*Scientific American*, 28/12.

ITALIAN "WHITE EAGLE" FOR OCEAN FLIGHT.—The correspondent of *The Daily Telegraph* at Milan reports that Signor Caproni has nearly finished the gigantic machine in which it is intended to fly from Italy to America. The machine is a huge triplane with engines of 3000 horse power and ample accommodation for a certain number of passengers, for whom cabins and sleeping berths will be available.

It is proposed that the aviators take the same route as Columbus did, flying from Italy to Cadiz and the Azores and thence to the American coast and landing near Washington.—*N. Y. Times*, 11/1.

OUR ARMY OF FLIERS.—In his recent annual report Major General William L. Kenley, director of military aeronautics, states that 4980 men had been graduated as reserve military aviators, the first rating for pilots, by June 30, last, with 110 bombers, 85 bombing pilots, 464 observers, 389 observer pilots, and 131 pursuit pilots. In the year ended last June 30 there were 152 fatalities in training, or an average of one death to 2684 hours and 201,000 miles flown. Stalled engines, usually due to an error of the pilot, caused 86 deaths; collisions, 30; and sideslips, 10. The report goes on further to state that 440 balloon officers also had been graduated, 155 of whom were fully qualified observers during the year.—*Scientific American*, 28/12.

AN AIRPLANE BUILT TO BE SHOT DOWN.—Until quite recently, the usual way for a machine gunner to train for his pleasant task of bringing down Boche airplanes has been to blaze away at captive balloons. At best, this has been tame sport. Another way has been to use the so-called camera gun, which records the "hits" on a film or plate; but the main objection to this procedure is that a substitute is used for the gun, and that the "hits" cannot be determined until the negative is developed some time later. It has remained for an American aircraft builder to introduce a diminutive airplane which flies itself without the aid of any human hand to guide it, and which can therefore be used as a target, thus bringing realism and efficiency to the aerial gunnery schools.

The target airplane is of the Burgess-Dunne type, modified to meet the conditions for which it was designed. Inherent stability is obtained by employing a large sweepback and negative dihedral angle. The course of the machine is governed by setting and locking the control surfaces in position prior to flight. The duration of flight may be governed by limiting the fuel supply or by employing an automatic timing device to control the throttle. By the proper setting of the controls, the machine can be made to fly in a spiral path until its fuel is exhausted, whereupon it will assume its natural gliding angle and land approximately at its starting point. This fact makes it an easy matter to recover the machine after a flight, if it has not been shot down before exhausting its fuel.

The little machine is of the seaplane design, to facilitate starting and alighting. It has a span of 18 feet 5 inches. The cord is only 28 inches. The length is 9 feet, while the overall height is 4 feet 8 inches. Although the weight of the complete machine is only 175 pounds, it is capable of carrying a man. The power plant consists of a 12 horsepower, four cylinder motorcycle engine, which has been rebuilt to meet the special requirements. The engine drives a 42-inch propeller, since the machine is of the "pusher" category. While climbing, the diminutive airplane develops a speed of 40 miles per hour, which rises to 50 when flying on a level keel.

Firing at the target airplane, the aerial-gunnery students get excellent practice. They use actual machine guns firing actual cartridges, and operate under conditions pretty close to actual aerial combat. It is not to be supposed that the target airplane is shot down on its initial flight; in fact, its life is considerable because of the difficulty of scoring a vital hit. Most shots merely perforate the wings or clip the structural members, and a few minutes' overhauling soon prepares the target machine for further flights.—*Scientific American* 28/12.

MISCELLANEOUS NOTES

HUNTING WILD FOWL IN PLANES FORBIDDEN BY AERO DIRECTOR.—The Director of Military Aeronautics has ruled against the shooting of wild fowl with machine guns from airplanes.

The shooting of wild fowl with machine guns from airplanes is absolutely forbidden. Airplanes will not be used in any manner for hunting or shooting wild fowl. Airplane flights along the coast, or any place where migratory wild fowl may be found, will be conducted in such a manner as to interfere as little as possible with the habits and feeding of the wild fowl.

Commanding officers will use every means to carry out the regulations and will bring to trial any offenders that may in the future be guilty of breaking any of them.—*Official Bulletin*, 10/1

NAVAL UNIFORMS AT COST.—*Senate Passes House Bill for Equipping Officers.*—The Senate yesterday passed the House bill authorizing the government to furnish uniforms and equipment to naval officers at cost.

Another House bill providing for the temporary promotion of officers of the marine corps now serving with the army also was approved. Both measures now go to the White House for the President's approval.—*Washington Evening Star*, 16/12.

The U. S. cruiser *Milwaukee*, which went ashore at Eureka, Cal., January 13, 1917, has broken in two, it is reported, and is beyond saving. She was 426 feet in length, with a full load displacement of 10,839 tons, and had a speed of 22.22 knots. She was launched in 1904, and was first commissioned in 1906. Her main battery consisted of fourteen 6-inch guns. The contract price of her hull and machinery was $2,825,000.—*Army and Navy Journal*, 11/1.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

TIMES CURRENT HISTORY. **January.**—Surrender of the German Fleet, by an eye witness. United States Navy in the War (from *Secretary of the Navy's Report*). Brave Deeds of the Marine Corps (from *Secretary of the Navy's Report*). Total Damage Caused by U-Boats.

THE WORLD'S WORK. **January.**—Germany's Future Military Position (Possible Alliances in the East), by *J. B. W. Gardiner.*

ATLANTIC MONTHLY. **January.**—The Idea of a League of Nations, by the *British League of Free Nations Association.* Freedom of the Seas and Our Merchant Marine (an argument for international control of merchant marine), by *Bernard N. Baker.*

INDUSTRIAL MANAGEMENT. **January.**—Ford Methods in Ship Manufacture, by *Fred E. Rogers.*

NATIONAL GEOGRAPHIC MAGAZINE. **November.**—A New Guide for Shipping (Navassa Light Off Jamaica), by *George W. Putnam.*

NAUTICAL GAZETTE. **January 11, 1919.**—Structural Details of Concrete Ships, by *W. Noble Twelvetrees,* M. I.

SCRIBNER'S MAGAZINE. **January.**—Fighting in France With the Marines, by *Lieut. Newton Jenkins.*

SHIPPING. **December 28, 1918.**—Progress in Turbine Ship Propulsion, by *Frances Hodge Curson.*

SCIENTIFIC AMERICAN. **January 11.**—Curious German Projectiles. **January 18.**—Battleship Strength of the Five Leading Naval Powers.

COLLIER'S WEEKLY. **January 18.**—Flying Down the Coast (with American Naval Forces on the French Coast), by *James B. Connolly.* America's Opportunity—the Far East, by *Edgar Mels.*

FLYING. **January.**—Aerial Transportation, by *Henry Woodhouse.*

COUNTRY LIFE. **January.**—(Navy Number). The Navy and its Job, by *Henry M. Beston.* Navy Paintings, by *Reuterdahl.*

JOURNAL OF CLEVELAND ENGINEERING SOCIETY. **November.**—The Inspector's Standpoint in Munition Production, by John T. Marsh.

GREAT BRITAIN

NINETEENTH CENTURY. **December.**—Gibraltar and Ceuta, by *Gen. Sir Chas. Callwell.* "Perfide Albion" (British Treaties With Sweden), by *Sir Francis Piggott.*

LAND AND WATER. **December 5.**—The Freedom of the Seas, by *Arthur Pollen.* **December 19.**—The Victory of the Fleet, by *Arthur Pollen.* Victors of the Air, by *Boyd Cable.* The Surrender of the Submarine, by *Captain Woodis Rogers.*

UNITED SERVICE MAGAZINE. **December.**—Comparisons in German Strategy, by *Lieut. Col. C. H. Wilson.* The Dutch Convoy and the Right of Visit and Search, by *Hugh L. Bellot, D. C. L.*

ENGINEER. **January 3.**—Four Years of Naval Progress (to be inserted in March *Institute*). Aeronautics, 1914-1918. Shipping in 1918.

ENGINEERING. **January 3.**—Crossing the Atlantic by Air.

DIPLOMATIC NOTES

From December 20 to January 20

PREPARED BY

Allan Westcott, Ph. D., Instructor, U. S. Naval Academy

OPENING OF THE PEACE CONFERENCE

Preliminary Meetings of Supreme Council.—Following his visit to Italy, President Wilson returned to Paris on January 7. The first meeting of the Supreme Council of the Peace Congress, consisting of the Premiers, Foreign Ministers, and other representatives of Great Britain, France, the United States, Italy, and later Japan, met at the Foreign Office in Paris on Monday, January 12, and sessions of this body were continued throughout the week. Questions of rules of procedure, admission of delegates, etc., were considered.

It was agreed that for the present no representative of any government in Russia could be admitted, since such recognition would commit the conference to a decision on the whole Russian question.

Following two sessions on January 15, this joint communiqué was issued, giving the number of delegates allotted to various nations:

"The President of the United States and the Prime Minister and Foreign Ministers of the Allied Powers, assisted by the Japanese Ambassadors in Paris and London, held two meetings to-day. In the course of these meetings the examination of the rules of the conference has been continued and almost completed.

"It was decided that the United States, the British Empire, France, Italy, and Japan should be represented by five delegates apiece. The British Dominions and India, besides, shall be represented as follows: Two delegates respectively for Australia, Canada, South Africa, and India, including the native States, and one delegate for New Zealand.

"Brazil will have three delegates. Belgium, China, Greece, Poland, Portugal, the Czechoslovak Republic, Rumania, and Serbia will have two delegates apiece, Siam one delegate, and Cuba, Guatemala, Haiti, Honduras, Liberia, Nicaragua, and Panama one delegate apiece.

"Montenegro will have one delegate, but the rules concerning the designation of this delegate shall not be fixed until the moment when the political situation in this country shall have been cleared up.

"The meeting adopted the following two general principles:

"One—Each delegation being a unit, the number of delegates forming it shall have no influence upon its status at the conference.

"Two—In the selection of its delegation each nation may avail itself of the panel system. This will enable each State at discretion to entrust its interests to such persons as it may designate.

"The adoption of the panel system will in particular enable the British Empire to admit among its five delegates representatives of the dominions, including Newfoundland, which has no separate representation, and of India."

COMPROMISE ON ADMISSION OF THE PRESS.—The question of rules for the admission of press representatives, involving the whole problem of secret or "open" diplomacy and publicity of discussion, came up in the preliminary sessions of January 16 and 17. The American delegates, according to Secretary Lansing, admitted the necessity of closed doors during preliminary discussion, but favored admission of the press when questions came up for final action, and immediate publication of all agreements reached.

The Council on January 17 issued a long and convincing argument in support of its final decision. This was that preliminary discussions and committee meetings should be held in private. "Representatives of the press shall be admitted to the meetings of the full conference, but upon necessary occasions the deliberations of the conference may be held in camera."

FIRST PLENARY SESSION.—The Peace Conference was formally opened at 3.00 p. m. on Saturday, January 18, in the Salle d'Horloge, now rechristened the Salle de la Paix, of the French Foreign Office. President Poincaré welcomed the delegates. President Wilson and Premier Lloyd George then nominated Premier Clemenceau as permanent chairman. In his speech of acceptance M. Clemenceau stated that the program of the Conference included three main subjects of general order: (1) responsibility of the authors of the war; (2) responsibility for crimes committed during the war; and (3) legislation in regard to international labor. On these three questions all powers represented would be invited to present memoranda. The powers particularly concerned would be invited to present memoranda on various territorial, economic, and financial questions.

The league of nations, he added, would be placed at the head of the order of the day of the next full session. The session was then adjourned.

It appears that few full sessions are likely to be held. It may be remembered that the Congress of Vienna met but once in plenary session and did nothing then. At the Congress of Vienna the four victorious powers made the decisions. In the present conference there is a prospect that the Supreme Council of five powers may play a similar rôle, acting as arbiters of the conflicting claims of small nations.

PEACE AIMS OF FRANCE.—On December 29 Foreign Minister Pichon answered in the Chamber of Deputies certain inquiries as to the peace policies of France, as follows:

"First.—That the government was in accord that the utmost publicity should be given to the Peace Conference.

"Second.—That the French Government had adopted the principle of a League of Nations and was now busy working toward its effective realization.

"Third.—That the government did not desire any annexation, but reserved the right to fix the Alsace-Lorraine frontiers, to guard against future attack.

"Fourth.—That the government did not think that the question of diplomatic representation of the Vatican arose at the present moment.

"Fifth.—That intervention in Russia was inevitable.

"Pichon explained, reading from instructions issued by Premier Clemenceau to the General commanding, that such intervention was not offensive for the time being, but defensive, in order to prevent the Bolsheviki from invading the Ukraine, the Caucasus, and Western Siberia. In the future an offensive intervention might be necessary in order to destroy Bolshevism. Such an operation must be carried out by Russian troops, of which 100,000 were at the present time ready at Odessa."

MARSHAL FOCH WANTS RHINE BARRIER.—In a statement to American newspaper correspondents at Treves on January 17, Marshal Foch advocated barring German military establishments or control of strongholds west of the Rhine; in other words, while France sought no territorial accessions west of the Rhine other than Alsace Lorraine, he advocated making the Rhine a military barrier against future German aggression.

"The Rhine," he said, "is the common barrier of all the Allies; it is the guaranty of peace for all those peoples who have shed their blood for liberty in this war.

"We have no idea of attacking Germany or reopening the war. Democracies such as ours never force an attack. They ask only to live and develop in peace. But who can say that Germany—where democratic ideas are new and perhaps very superficial—will not recover rapidly from her defeat and in a few years attempt a second time to crush us?

"Russia is hors de combat for years. England must cross the channel. America is far away.

"France should be in a position (*en mesure*) to safeguard the general interests of humanity. These meet at the Rhine. It is there that we must plan to prevent surprises, unfortunate for the future."

Marshal Foch declared that his plan linked up with the League of Nations, since it would be the duty of such a league to see that decisions regarding the Rhine provinces were carried out.

AIMS OF GREAT BRITAIN.—An interpreter of the war aims and claims of Great Britain, in an interview of January 17, mentioned her desire for a League of Nations, for a good working agreement with the United States, for peace and facilities of trade and transit in Europe. Regarding freedom of the seas and free trade, he spoke as follows:

"As to the freedom of the seas, Great Britain, it is maintained, will in the future as in the past aim at securing the greatest possible freedom for commerce to all nations in times of peace. This is what she means by the freedom of the seas. The question of the rules of warfare by sea she considers quite separate and as requiring discussion, but she hopes that the causes of the war will be removed.

"Great Britain desires the greatest freedom of trade on land and sea and she expects a League of Nations to guarantee this. Before the war British colonies were open to the world. The British consider that Germany abused the privileges offered and that each German tradesman was a potential spy and Great Britain has no desire to return to this condition of affairs. She wants to rid trade of the political element which Germany injected into it.

"Great Britain does not want to become a protectionist power, but she does not wish free trade to put her at a disadvantage. Unless the Peace Conference eliminates the objectionable features existing before the war, it is probable that Great Britain would be forced to defend herself by special laws."

THE ALLIES IN THE NEAR EAST.—Paris, Jan. 1 (Associated Press).—France plans to assume the guidance of the destinies of Armenia, Syria, and Lebanon in the new order of world affairs, in conformity with treaties signed with Great Britain and Russia in 1915, if the Peace Conference does not rule otherwise, according to authoritative information furnished the Associated Press.

Palestine, according to the plan under consideration, would, with its complexity of nationalities and religions, be placed under international protection. England would be responsible for the Arabian peninsula, with the exception of the Kingdom of Hedjaz, which would be free.

France, it is emphatically stated, eschews the term "protectorate" in connection with her proposed supervision of these countries, and it is probable that some such relation with them as exists between England and her Dominions would be established.

These facts were given as an explanation of the declaration of Stephen Pichon, Foreign Minister, in the Chamber of Deputies Sunday. Referring to the manner in which France would deal with Asia Minor and nationalities formerly ruled by Turkey, M. Pichon said:

"We have nothing but friendly feelings for the Turks, and we have testified to them in protecting subjugated nations in the Ottoman Empire over which we have century-old rights. . . . Our rights are incontestable in Armenia, Syria, Lebanon, and Palestine. They are based on historic conventions and on more recent contracts. While admitting the entire liberty of the Peace Conference to deal with the subject, we consider our rights are fully established by our agreements with Great Britain."

THE LEAGUE OF NATIONS

ESSENTIAL AGREEMENT ANTICIPATED.—Among the 40 or more plans of a League of Nations submitted to the Peace Conference, no definite choice was made, or at least no official announcement issued by the American or other delegates, prior to the opening of formal sessions of the Conference. Press reports, however, indicated that essential agreement had been reached on this point between President Wilson and British leaders during the President's visit to England, and that the President was willing to accept British views regarding freedom of the seas.

It was further reported on January 16 that as a result of recent conferences between Lord Robert Cecil, Secretary Lansing, and Col. House, a covenant had already been drawn up embracing 13 articles and eight supplementary provisions, which brought together the main features of all plans presented.

The American delegation, it was said, would urge that whatever project was adopted should be included in the peace treaty, and that the League of Nations should be one of the first topics considered at the plenary conference.

THE FRENCH PLAN.—On December 21, M. Leon Bourgeois and Baron d'Estournelles de Constant presented to Premier Clemenceau the plan for a League of Nations formulated by the French association for promoting such a league. This plan, as summarized in the *New York Nation*, included the following points:

1. Compulsory arbitration without limitation or any exception of questions involving national honor or dignity. 2. Limitation of armaments. 3. The establishment of a council of administration of the nations for

the formulation of new international administration and international legal procedure. 4. The application of diplomatic, judicial, economic, and, as a final resort, military sanctions to enforce upon recalcitrant nations the decisions of the league. In explaining the plan Baron d' Estournelles de Constant is reported as saying: "There will be different views concerning the military enforcement of peace. Our aim is to reconcile these differences and secure some workable basis of agreement."

THE "AMERICAN PLAN."—An Associated Press dispatch from Paris dated January 7 gave the following suggestions as to the plan favored by the American representatives:

The American point of view, as it is now being formulated by the specialists, seeks to reach an accord on fundamentals on which all agree and present them in simple working form. One of the chief of these fundamentals is the formation of a league which will embrace all the nations of the world, but not one which will establish any balance of power among the group of nations.

Also, care is being taken that the influence of the various nations in the league shall be in accordance with their size and importance, so that the great powers and the small will have voices according to their standing.

Another feature especially concerning small, undeveloped nations, is to be established, according to the American plan—a system of international trusteeship whereby the various larger nations, having a developed and stable civilization, will act as trustees for the Society of Nations in fostering the progress and development of undeveloped communities.

It is recognized that the League of Nations will have to have some established and permanent seat for its extensive international work, and the gradual conviction is taking form that this seat will be Versailles.

CLEMENCEAU FAVORS BALANCE OF POWER

No franker or more authoritative indication can be found not only of the conciliatory attitude of the allied nations, but also of their divergences of opinion, than in the remarks of Premier Clemenceau to the Chamber of Deputies on the night of December 29.

The Chamber afterward supported the Premier by a strong vote of confidence, only the Socialist wing failing to approve his views.

Replying to charges made by Albert Thomas, Socialist leader, that he had kept the Chamber without information, Premier Clemenceau said:

"The question of peace is a tremendous problem. It is a question which is one of the most difficult ever submitted to the nation at any time. In a few days a conference of delegates will meet at Paris which will settle the fate of nations in all parts of the world.

"People say: 'Premier Lloyd George has spoken, President Wilson has spoken, but you have said nothing.' I have given explanations whenever you have asked me. But it isn't because Mr. Lloyd George has spoken, or because Mr. Wilson has arrived from America with elevated thoughts that I am obliged to explain myself and keep running to the Speaker's rostrum.

"France was in an especially difficult situation. It was the country nearest Germany. America was far away and took her time to come into the war. England came at once at the call of Mr. Asquith. We suffered and fought; our men were mowed down and our towns and villages were destroyed.

"There is an old system of alliances called the 'balance of power.' It seems to be condemned nowadays, but if such a balance had preceded the war; if England, the United States, France, and Italy had agreed;

say, that whoever attacked one of them attacked the whole world, the war would not have occurred. This system of alliances, which I do not renounce, will be my guiding thought at the Peace Conference if your confidence sends me there.

"I have been reproached with deceiving President Wilson. I do not understand why. I have made it a rule not to question him, but to let him develop his views. That is what he did. President Wilson, to whom certain persons, in the interest of their parties, attribute intentions which, perhaps, are not his, has opened his mind and has inspired respect through his simple speech and the nobility of it. President Wilson said to me: 'I will try to convince you, but perhaps you will convince me.'

"You know that reservations have been made on the question of freedom of the seas. Premier Lloyd George said to me one day: 'You will admit that without the British fleet you could not have continued the war.' I answered in the affirmative. The British Premier then asked me if I was disposed to do anything in opposition to British ideas on the freedom of the seas. I answered in the negative. Concerning this question, President Wilson said to me:

"'I approve of what you said. What I have to offer the allied governments will change in no way your answer to Premier Lloyd George.'"—*N. Y. Times*, 31/12.

AMERICA WILL JOIN WITH ALL OR NONE.—At Manchester, the stronghold of British liberalism, on December 30, at almost the same time as M. Clemenceau's speech in favor of a permanent league of the Allies, President Wilson declared that the United States "will join no combination of power which is not a combination of all." There follows the part of this speech which refers to a League of Nations:

"And so it does seem to me that the theme that we must have in our minds now in this great day of settlement is the theme of common interest and the determination of what it is that is our common interest. You know that heretofore the world has been governed, or at any rate the attempt has been made to govern it, by partnerships of interest, and that they have broken down. Interest does not bind men together. Interest separates men. For, the moment there is the slightest departure from the nice adjustment of interests, then jealousies begin to spring up. There is only one thing that can bind peoples together, and that is common devotion to right.

"Ever since the history of liberty began men have talked about their rights, and it has taken several hundred years to make them perceive that the principal condition of right is duty, and that unless a man performs his full duty he is entitled to no right. It is a fine co-relation of the influence of duty that right is the equipoise and balance of society.

"And so, when we analyze the present situation and the future that we now have to mold and control, it seems to me there is no other thought than that that can guide us. You know that the United States has always felt from the very beginning of her history that she must keep herself separate from any kind of connection with European politics. I want to say very frankly to you that she is not now interested in European politics, but she is interested in the partnership of right between America and Europe. If the future had nothing for us but a new attempt to keep the world at a right poise by a balance of power the United States would take no interest, because she will join no combination of power which is not a combination of all of us. She is not interested merely in the peace of Europe, but in the peace of the world.

"Therefore it seems to me that in the settlement which is just ahead of us something more delicate and difficult than was ever attempted before has to be accomplished—a genuine concert of mind and of purpose.

Sir Eric Geddes, appointed Minister Without Portfolio, will undertake the management of demobilization; and Mr. Barnes, also without portfolio, will represent Labor at the Peace Conference.

The Cabinet is regarded as temporary in character, and likely to be altered following the Peace Conference and upon the resumption of home policies.

PLANS OF THE SINN FEINERS.—Following their election of 73 out of 80 Irish members of parliament, the Sinn Feiners declared their intention to refrain from taking seats in the House of Commons and to meet instead in Dublin as an Irish National Assembly. The plans for the Assembly were delayed by the fact that 34 of those elected were still in jail, though it was rumored that the government would soon release them. The *London Globe* published on January 9 a draft of what purported to be a Sinn Fein constitution for Ireland, making the country an independent republic. January 21 was set as the date for the Dublin Assembly.

SHIFT OF GIBRALTAR DISCUSSED.—Paris, Dec. 26.—The cession of Spanish Morocco to France in exchange for a cash consideration of 1,000,000,000 francs, the return of Gibraltar to Spain by Great Britain and the abandonment of Ceuta, Morocco, to Great Britain by Spain are being openly discussed. It is asserted that the Spanish Premier, Count Romanones, recently, during his visit to Paris, made such a proposal to President Wilson and M. Clemenceau, the French Premier. While officials have declined either to confirm or deny this report, the question was freely discussed in the corridors of the Chamber of Deputies this afternoon.

There also has been a renewal of the talk of building a tunnel across the Strait of Gibraltar and making a direct all-land connection between Africa and France which might be extended to England if the English Channel were tunneled.—*N. Y. Times*, 28/12.

DISPOSITION OF GERMAN COLONIES.—Special Cable to *The New York Times*.—Paris, Dec. 23.—In the course of a conversation on peace conference problems a French statesman surprised me to-day by saying that France was not particularly interested in the question of the German colonies.

"That is a matter," he said, "which the French consider as exclusively British, and we are prepared to agree unquestioningly to any conclusion Great Britain reaches."

I asked him if he meant that literally to the extent of agreeing to the restoration of part of the colonies, should England so decide.

"Yes, we would agree to anything," he replied, "but there is no danger of the British consenting to their restoration.

"There are three sufficient reasons for not restoring the colonies.

"The first concerns the naval activity of future wars. There is no question in French opinion that the submarine will be the chief naval machine of the future. It is true that after peace is signed and we get to a second congress for such matters as a League of Nations, we shall try to formulate some rule to prohibit submarine atrocities in future wars; but nevertheless it will not be forgotten that we have to deal with Germany and have to watch her submarine activities. For that reason England cannot afford to let Germany have colonies which would serve as building places and bases for powerful submarine fleets.

"Second, it is greatly to be feared that Germany would in future use her colonies as places in which to raise, train, and equip vast black armies to be transported to Europe.

"Third, there are the political relations between England and her African possessions. They constitute a great factor in the German colony problem. The German colonies were conquered not by the English, but by British colonial troops, largely from South Africa, where there is a mixed English and Dutch population. These English colonies will not tolerate the restoration of the German colonies and the consequent menace to themselves. So Great Britain now has a chance, by letting Cape Colony keep what it has won, to build up in that colony the same loyalty and devotion to the Crown that exists in Canada and Australia."

JAPAN WOULD RETAIN PACIFIC ISLANDS.—In a statement of November 18 regarding Japan's attitude in the Peace Conference, Premier Okuma declared that in general Japan should approve all decisions reached by her allies. Regarding problems in the Pacific, he is reported as follows:

"The future of the Samoan Islands, which has caused various diplomatic controversies between Great Britain, the United States, and Germany, should be decided in accordance with the will of the former two powers for the purpose of destroying German bases in the Pacific.

"The German New Guinea, which is now occupied by the British, should not be returned to Germany. The principle should also be applicable to the Bismarck Islands.

"Japan should hold islands like the Marshall, Caroline, and others, which are now occupied by the Japanese Navy, as it is dangerous to return them to Germany, and as there is no reason to let other powers occupy them.

"The cable line between Tsingtao and the Southern Islands, which is now occupied by the Japanese Navy, should be held by Japan. The cable line is a property owned by a private concern, so that Germany should buy it up before conceding it to Japan.

"The problems relating to the maintenance of order in Siberia should be settled by the allied conference, but all the allied powers should refrain from any action or demand for acquiring concessions in Siberia.

"The relations between China and other powers should be based upon the principle of open-door and equal opportunity."—*N. Y. Times*, 19/11.

GERMANY

SOVIETS VOTE POWER TO EBERT CABINET.—Before its dissolution in the third week of December, the Congress of German Soldiers' and Workmen's Councils voted to transfer legislative and executive power to the People's Commissioners (the six members of the Ebert Cabinet). The Congress also elected a permanent Soviet Advisory Council of 27 majority Socialists, and voted down a resolution to exclude bourgeois parties from participation in elections to a National Assembly.

THE CHRISTMAS REVOLT IN BERLIN.—Serious disturbances were renewed in Berlin during Christmas week, the immediate cause being an order of City Commandant Wels that the pay of marine divisions from Kiel should be withheld unless they disbanded or left Berlin. Sailors and marines on the night of December 23-24 seized the royal palace and stables, and made attacks on other government buildings. The forces of Police President Eichhorn, afterward dismissed as an adherent of the Sparticides, supported the mutineers. After considerable bloodshed, a compromise was effected with the government in control.

INDEPENDENTS QUIT CABINET.—When on December 28 the Central Soviet Council of Twenty-Seven approved the action of Ebert, Scheidemann, and Landsberg in employing force to put down insurrection, the three Independent Socialists of the Cabinet—Haase, Barth, and Dittmann—resigned. They stated, however, that their action did not signify approval of the violent Sparticide tactics. Three Majority Socialists, Noske, Loebe, and Wissel, were appointed in their stead. Herr Noske, formerly Military Governor at Kiel, undertook control of the government military forces in Berlin.

SPARTICIDE REVOLT SUPPRESSED.—With the evident policy of breaking up the Ebert government and preventing the convocation of a National Assembly, the Sparticide or Liebknecht faction in Berlin carried on violent disturbances throughout the week of January 6-12. Eichhorn, the deposed Sparticide police chief, refused to turn over his office, and his headquarters became a center of the revolutionary movement. During these days immense crowds thronged the streets of Berlin, rioters fired on government troops and attacked public buildings, and bloody struggles ensued for possession of the strongholds of each side. The Sparticides for a time held the War Office, Police Headquarters, several railway stations, and the chief newspaper offices. On January 11 government troops forced the surrender of the Vorwaerts Building after it had been in the hands of the Sparticides for almost a week. Some 400 of its defenders were taken prisoners. On January 15 the revolution apparently was completely suppressed. Dr. Karl Liebknecht on that date was shot by soldiers while attempting to escape from custody; and the woman agitator, Rosa Luxemburg, was beaten and shot to death by a mob. Estimates placed the number of rioters killed at over 1000. The total number killed on both sides in street fighting was far greater.

PEACE CONFERENCE CONSIDERS LIFTING BLOCKADE.—In view of the Bolshevistic agitation in Germany and the necessity of military occupation of the entire country if the Ebert government were overthrown, the allied delegates at the Peace Conference took under consideration a partial lifting of the blockade and the sending of food to Germany. This was provided for in the renewal of the armistice referred to elsewhere. In response to an urgent message from President Wilson, the United States Congress appropriated $100,000,000 for immediate relief measures in Europe.

NEW CONSTITUTION DRAFTED.—Berlin, Jan. 15 (via Copenhagen).—The Ebert Government has prepared a draft of a new constitution which will be submitted to the National Convention soon after it assembles, probably on February 10.

The draft provides that the President shall be elected for ten years by direct vote of the whole people. He may be re-elected.

The union of States yet to be formed will be on the American principle, Statehood being accorded to any population over 2,000,000. It is planned to divide Prussia into eight separate Slates.—*N. Y. Times,* 17/1.

ELECTIONS FOR NATIONAL ASSEMBLY.—While civil war was raging in Berlin, election campaigns were proceeding throughout Germany for the choice of delegates to the National Assembly. Elections already held indicated overwhelming popular support for the more conservative parties.

Elections were held in Berlin on Sunday, January 19. Foreign Secretary Scheidemann at that time announced that the Assembly would be convoked on February 16.

LUXEMBOURG DUCHESS DEPOSED.—An opera bouffe revolution occurred in Luxembourg in the middle of January, when the Grand Duchess Marie Adelaide abdicated and her younger sister, Princess Charlotte, succeeded.

While the opposition to the Grand Duchess aimed at a republic, Premier Alweiss succeeded in limiting the change to a shift of rulers. The new régime is, however, more acceptable to the Allies, since the Grand Duchess Marie Adelaide was said to be reconciled to German occupation of her territory.

ITALY

ITALY SPLIT OVER PEACE CLAIMS.—At the close of December Minister of Pensions Leonida Bissolati resigned from the Orlando Cabinet, giving as his reasons his failure to induce Foreign Minister Sonnino to compromise with the Jugoslavs.

"I have failed," he said, "to move Baron Sonnino away from these three clauses of the secret treaty of London: (1) Annexation of a large portion of Dalmatia from Hissariki and Trebuije to Cape Planpa (Article 5); (2) Permanent retention of all the 13 islands of so-called Dodecannese with their almost exclusively Greek population (Article 8), and (3) Inclusion within Italian territory of the German population of the Northern Tyrol as far as the Brenner (Article 4). Baron Sonnino insists on the absolute intangibility of the secret treaty of London."

While war was still going on, the moderate attitude of Bissolati received strong popular support, especially from the Socialists; but victory strengthened the hand of the Annexationists. The position of the latter is stated in the following extracts from a letter issued by Captain Tozzi and Lieut. Pecorini, members of the Italian Mission to the United States:

"No matter how much Italy and the other Allies may desire the union and prosperity of future Jugoslavia, the present status of the Slovenes, Croatians, Bosnians, and Herzegovinians is the same as that of the Prussians; they are defeated enemies. England believes that a truly repentant Prussia is necessary in order to have peace in the North Sea; Italy believes that a truly repentant Slavonia and Croatia are necessary in order to have peace in the Adriatic.

"The terms of the present armistice are the terms of the Allies and not only of Italy.

"Even not considering historical, cultural, and strategic rights, Italy possesses to-day enough military and naval strength to obtain and maintain for a long time to come the settlement which she considers necessary for her security. Besides the strength she has a treaty which, secret or not, desirable or otherwise, has no more and no less validity than all other similar treaties and understandings between the Allies, and constitutes an integral part of a general situation, involving not only the interests and the policy of Italy, but the interests and the policy of England and France as well.

"The Jugoslavs of the former Austrian Empire have furnished all through the war and to the very last battle the divisions that fought with most bitterness against the Allies on the Italian front; all Italian soldiers confirm this fact.

"Before pleading, as they now do, for a united Jugoslavia outside of Hapsburg influence, a very large number of Slovenes and Croats agitated and intrigued for months to constitute a Jugoslav State federated with Austria, and have only unwillingly come to their present position.

"These facts, which unfortunately Italian liberals are not able to deny, have been strengthening more and more the position of the conservatives, who are unwilling to take any chances with the Jugoslavs, and insist on absolute guarantees.—*N. Y. Times*, 8/1.

ORLANDO CABINET REORGANIZED.—On January 13, Premier Orlando was recalled from Paris by the resignation of Finance Minister Nitti and other members of his cabinet. Nitti is leader of the Catholic party in Italy, which has recently been greatly strengthened by fears of Bolshevism and a consequent withdrawal from Socialistic parties. His action was therefore regarded as a move to secure control of the government. Premier Orlando, however, succeeded in reforming his Ministry, and on January 16 announced a new slate, with Baron Sonnino still in charge of foreign affairs.

PRESIDENT WILSON IN ITALY.—During President Wilson's visit to Italy in the first week of January, he gave no indication, other than might be drawn from his general principles, of his position regarding Italy's Adriatic claims. His closest approach to the Balkan question is contained in the following extract from his speech to the Italian Chamber of Deputies on January 3:

"The great difficulty among such states as those of the Balkans has been that they were always accessible to secret influence; that they were always being penetrated by intrigue of some sort or another, that north of them lay disturbed populations which were held together not by sympathy and friendship, but by the coercive force of a military power.

"Now the intrigue is checked, and the bonds are broken, and what we are going to provide is a new cement to hold the people together. They have not been accustomed to being independent. They must now be independent.

"I am sure that you recognize the principle as I do—that it is not our privilege to say what sort of a government they should set up. But we are friends of those people, and it is our duty as their friends to see to it that some kind of protection is thrown around them—something supplied which will hold them together.

"There is only one thing that holds nations together, if you exclude force, and that is friendship and good-will. The only thing that binds men together is friendship, and by the same token the only thing that binds nations together is friendship. Therefore our task at Paris is to organize the friendship of the world—to see to it that all the moral forces that make for right and justice and liberty are united and are given a vital organization to which the peoples of the world will readily and gladly respond.

"In other words, our task is no less colossal than this: To set up a new international psychology; to have a new real atmosphere. I am happy to say that, in my dealings with the distinguished gentlemen who lead your nation, and those who lead France and England, I feel that

atmosphere gathering, that desire to do justice, that desire to establish friendliness, that desire to make peace rest upon right; and with this common purpose no obstacles need be formidable."

SOUTHEASTERN EUROPE

CZECHO-SLOVAK REPUBLIC ORGANIZED.—On December 22 Prof. T. G. Masaryk took the oath of office as president of the new Czecho-Slovak state. A temporary National Assembly of 259 members was created, with each party represented according to its estimated strength; and a cabinet of 17 members was formed under Premier Kramarz, including eight Socialists and a Catholic priest as Minister of Railways. The tasks of the new government are stated as follows:

"The drafting of a constitution, the delimitation of Slovak territory withdrawn from Hungary, an agreement with the Poles as to claims in Austrian Silesia, an arrangement as to the debts of the defunct empire, a settlement of the status and rights of the German Bohemians, provision for the Czecho-Slovak troops still in Russia, and an emergency currency."

JUGOSLAV GOVERNMENT AND ASPIRATIONS.—A dispatch from Belgrad dated December 21 announced the formation of a Jugoslav cabinet, with M. Protitch as Premier and M. Trumbitch as Foreign Minister. M. Protitch was formerly Minister of the Interior in the Serbian cabinet, and M. Trumbitch is head of the Jugoslav Committee in Paris. On January 5 representatives of all the Jugoslav states—Serbia, Montenegro, Bosnia, Herzegovina, Dalmatia, Croatia, and Slavonia—met at Belgrad to carry forward the organization of the union. All manifestoes of the Jugoslavs assert their intention to press their territorial claims at the Peace Conference. Thus the Washington headquarters writes on December 25:

"The first thing the delegation will ask will be the full political and territorial recognition of the new State. The territorial claims, based upon the principle of justice and national self-determination, include in the new state all those territories where Jugoslavs live in compact masses and where they have formed since time immemorial an undisputed territorial continuity. These territories are Serbia and Montenegro, Bosnia and Herzegovina, Croatia and Slavonia, Dalmatia, Carniola, Istria and Trieste, Gorizia, parts of Southern Styria, parts of Carinthia, Baoska, and parts of Banat and Megjumurje.

"Except in the Adriatic coast lands there is no dispute about the righteousness of the Jugoslav claims. Trieste and the western part of Istria have a majority of Italians, but Trieste is a component and indivisible part of the whole Jugoslav hinterland, whereas the proportion of the population in the whole of Istria shows 224,000 Jugoslavs as against 145,516 Italians. But Italy claims besides Istria and Trieste the whole of Gorizia and the greater part of Dalmatia, where the Italian population is negligible, being 108,147, as against 767,708 Jugoslavs.

"Between Italian imperialistic and Jugoslav national claims there cannot be any compromise whatever. Only force can impose upon the Jugoslavs acceptance, for the moment, of a decision contrary to their rights. Any unjust settlement would unavoidably result in far-reaching future trouble. The Jugoslav peace delegation will have to make this point clear to the Peace Conference and to induce the Allies and America to arrange a settlement such as will assure not only peace in the Adriatic, but the very necessary good relations between Italy and the Jugoslavs."

That the Jugoslav Union is not yet fully established is suggested by a report on January 16 that a force of some 20,000 Montenegrins had organized to oppose Serbian troops. The so-called Montenegrin National Assembly which met and deposed King Nicholas was declared by the latter to be without popular sanction.

POLAND

PADEREWSKI HEADS NEW GOVERNMENT.—A Warsaw dispatch of January 16 announced that Ignace Paderewski, who as the representative of the Polish National Committee in Paris and with the somewhat more dubious sanction of American Polish organizations in America had for some time been attempting to establish a new national government in Poland, had reached an agreement with General Pilsudski, the military dictator then in control. In accordance with this agreement, a new government had been formed with M. Paderewski as Premier.

In the meantime German forces were organizing to resist Polish troops which had already occupied German Poland and were threatening the frontiers of Silesia and East Prussia. Czechs and Poles were at odds on the southern boundary of Poland. On the north, the advance of Bolshevik forces, following the German evacuation, threatened to interfere with Poland's ambition to extend her northern frontier.

Reports of dubious authenticity suggested that France and other of the western powers might favor a strong Polish state as a protection against Bolshevism, and on the condition that Poland should assume responsibility for a part of the repudiated Russian national debt.

RUSSIA

KOLCHAK DECLARES FOR POPULAR RULE.—An Omsk Associated Press dispatch of January 13 stated that Admiral Kolchak, the dictator at the head of the Omsk Government, had signed a paper proclaiming an All-Russian election of delegates to a Constituent Assembly, the election to be held "at the earliest practical moment." Admiral Kolchak at the same time defended his rule on the ground that he had been merely selected by his colleagues to guide Russia through her crisis, after which he would at once turn the country over to properly constituted civil authorities.

ALLIES UNDECIDED OVER RUSSIAN POLICY.—Aside from the conclusion that representatives of no government in Russia could be admitted to the Peace Conference for the present, the allied nations at the opening of the Conference had reached no definite decision as to their future policy toward Russia.

Early in January Great Britain made tentative proposals to her allies to the effect that all the various governments in Russia be invited to cease hostilities and make peace at home and abroad, following which these governments would be allowed to send delegates and present their claims at Paris.

To this proposal France expressed a vigorous dissent. On January 11, Foreign Minister Pichon issued a statement denouncing the régime of the Bolsheviki and declaring that negotiations with such a government would be counter to the principles which had guided the Allies, and virtually a compact with crime.

JAPAN RECALLS RESERVES.—Reports from Japan on January 9 stated that Japanese forces would be largely withdrawn from Siberia, the first withdrawal to be made in the latter part of February and to affect some 30,000 men.

BOLSHEVISM IN ARGENTINA

On January 10 a general strike was declared in Buenos Ayres and other cities of Argentina, and serious rioting and bloodshed occurred in the capital. General Deluepaine, commanding the government forces, assumed a temporary military dictatorship, ordered troops to fire on rioters, and within three days arrested some 8000 disturbers, thus checking disorder. It was stated that 809 of those arrested were Russians. Subsequent police investigation in Buenos Ayres, and also at Montevidio, Uruguay, showed that the disturbances were in large part the outcome of a Bolshevist movement started by foreign agitators.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"Naval Machinery." Third Edition. By H. C. Dinger, Commander, U. S. Navy. Price, $3.00. (New York: D. Van Nostrand Company.)

This is the third edition of the "Handbook for the Care and Operation of Naval Machinery," the first edition being published in 1908. This handbook was written "to fill a demand for a concise and simple description of the care and operation of naval machinery on many points not largely touched upon in the standard treatises on Marine Engineering."

In this latest edition new chapters have been added covering burning of fuel oil, warming up of turbines, tolerances, cylinder and piston bore clearances, lubrication, Bureau of Steam Engineering, Flange Tables, and electric steering gears. The chapters on inspections, clothing and lagging, feed heating, evaporators, piping, valves, cleaning and painting, work shop machinery, tools and spare parts, and tests of machinery and piping have been revised to bring them in accordance with the latest practice.

The description of each piece of naval machinery is concise and more thorough than that given in standard text books.

The special value of this handbook lies in what may be called "Wrinkles of operation and management." These "Wrinkles" cover concise and minute details of the care and operation and repair of naval machinery, details which are not found in ordinary text books. These details have been gleaned from all sources and cover latest practice. The subject of feed water heating is covered thoroughly, as are many other subjects, such as operation of evaporators, etc. Tables showing tolerances for boring bearings, standard valves and flanges are valuable additions to the first edition of this handbook.

F. W. M.

"Signaling in the U. S. Navy and Merchant Marine." Price, 25 cents. (Boston: Army and Navy Signal Publishers.)

A small, handy pamphlet, in which the various methods of signaling afloat are treated in a concise and easily understood manner. The text first takes up International Flag Signals and illustrates the method of making various hoists in this code. International fog signals, distress signals, and flag waving signals are treated in the same section. The second part takes up U. S. Navy Signal Methods and covers about the same ground as the signaling instructions in the Deck and Boat Book. Sketches are freely used to illustrate the various flag hoists, and the accompanying explanations are clearly worded, though perhaps not so precise as the official instructions on the subject. In the section devoted to call flags the publishers have been unable to describe the most recent practices on account

of their supposedly confidential nature. Wig-wag, blinker and semaphore are treated, as well as a "U. S. Navy Bugle Code," which, the publishers state, has been accepted by the U. S. Government, but appears to be of doubtful utility.

The booklet is accompanied by a revolving signal chart, which should be of considerable use to a beginner in enabling him to fix the various flags and characters in his mind. The card carries two concealed discs by which the alphabet flags, call flags, call pennants and characters of the semaphore code may be displayed in windows in the card proper. These flags and characters are repeated on the fixed part of the card, thus enabling a student to identify any one which he is unable to recognize on sight. It is somewhat to be regretted that the special flags used with the navy code were not incorporated with the alphabet flags, also that the characters of the dot and dash code were not included on the margin of one of the discs. With these improvements the card would cover all the signaling methods in general use.

Notwithstanding these omissions, candidates for the signal bridge, and in fact all who are interested in signaling, but who have not the opportunity for daily practice at actually reading all classes of signals, will find this card and the accompanying instructions a valuable aid. W. C. J. S.

"The A-B-C of Aviation." By Victor W. Pagé. Price, $2.50 net. (Published by The Norman W. Henley Publishing Co., New York.)

The following quotation from the title page of this book gives a general idea of its scope: "A complete, practical treatise, outlining clearly the elements of aeronautical engineering with special reference to simplified explanations of the theory of flight, aerodynamics and basic principles underlying the action of balloons and airplanes of all types. A nontechnical manual for all students of aircraft. This book includes instructions for lining up and inspecting typical airplanes before flight, and also gives easily understood rules for flying."

In my opinion the book is all that is claimed for it, and should prove most valuable to pilots and mechanics. It is couched in the simplest possible language and yet is far from elementary; indeed, some of the subject-matter is covered in a more thorough manner than in any similar work I have read.

The book consists of twelve chapters. The first three are very general: Chapter I dealing with elementary principles of aeronautics, Chapter II describing Lighter-Than-Air Craft, and Chapter III giving a historical sketch of the advance of the art of flying from Henson (1843) to the Wrights (1903). The design of wings is discussed in the succeeding chapter and typical aerofoil sections are illustrated.

Chapter V is devoted to the arrangement, construction and bracing of wings. The effect of gap is treated and the point is made that in the customary biplane arrangement where the gap/chord ratio is about 1 the efficiency is but 80 per cent of a monoplane of the same wing area and aerofoil section. Stagger has very slight effect on efficiency.

NOTICE TO MEMBERS

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

G. M. RAVENSCROFT,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership.

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To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the PROCEEDINGS, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The PROCEEDINGS are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

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"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

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"What Steps in Organization and Training Should be Taken to Maintain and Increase the Efficiency of the Navy at the Close of the Present War."

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"The Effect of the Present War upon Views Previously Held of Naval Strategy, Tactics and Logistics."

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SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

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THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

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A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

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45 MARCH 1919 No. 193

United States Naval Institute Proceedings

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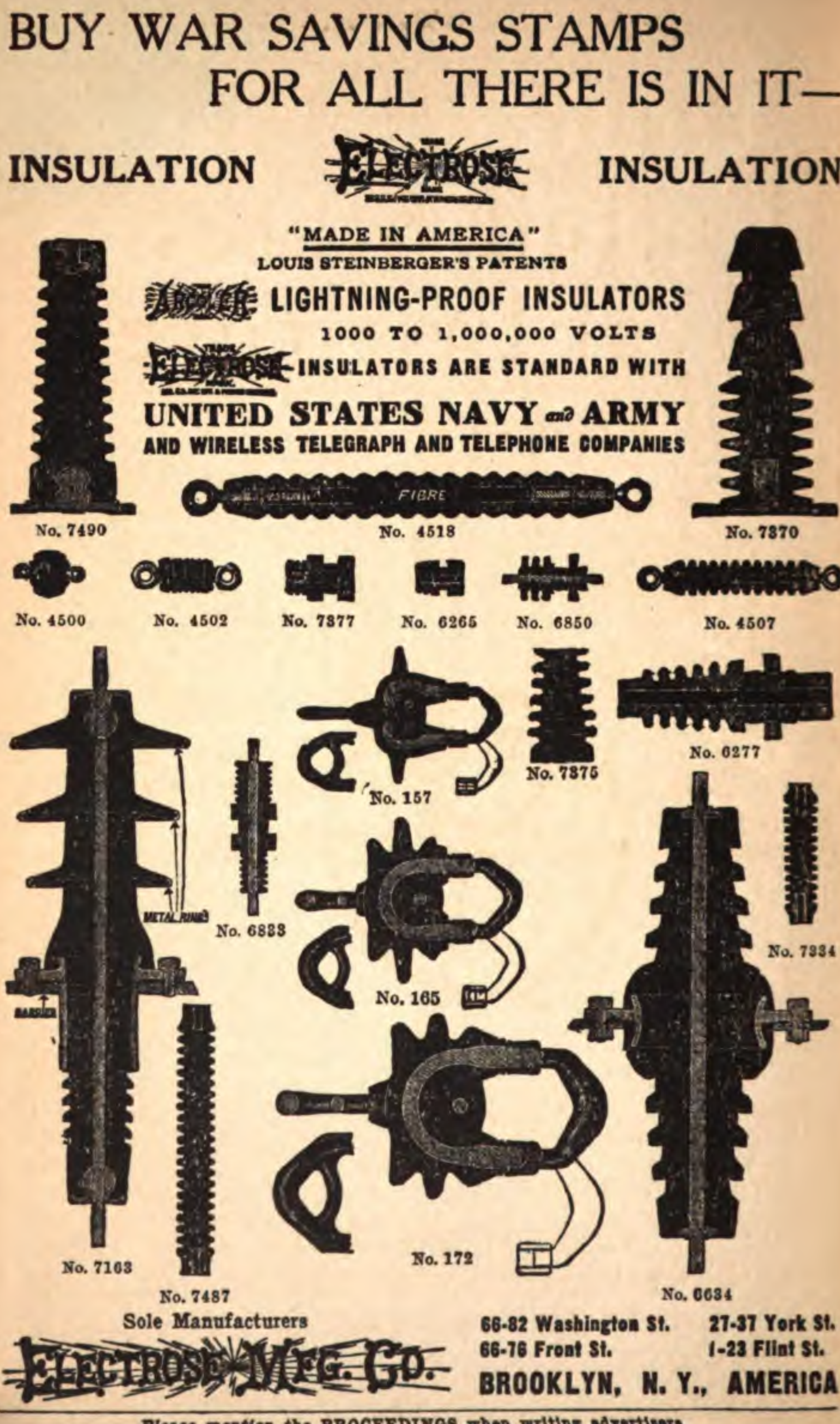
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BROOKLYN, N. Y., AMERICA

Vol. 45, No. 3 March, 1919 Whole No. 193

United States Naval Institute
Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

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SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,

Commander, U. S. N., Secretary and Treasurer.

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OF THE

U. S. NAVAL INSTITUTE

Admiral DAVID D. PORTER, U. S. Navy, 1873

Rear Admiral JOHN L. WORDEN, U. S. Navy, 1874

Rear Admiral C. R. P. RODGERS, U. S. Navy, Jan. 1875–Jan. 1878

Commodore FOXHALL A. PARKER, U. S. Navy, Jan. 1878–Jan. 1879

Rear Admiral JOHN RODGERS, U. S. Navy, Jan. 1879–Jan. 1882

Rear Admiral C. R. P. RODGERS, U. S. Navy, Jan. 1882–Jan. 1883

Rear Admiral THORNTON A. JENKINS, U. S. Navy, Jan. 1883–Oct. 1885

Rear Admiral EDWARD SIMPSON, U. S. Navy, Oct. 1885–Oct. 1887

Rear Admiral STEPHEN B. LUCE, U. S. Navy, Oct. 1887–Oct. 1898

Rear Admiral WM. T. SAMPSON, U. S. Navy, Oct. 1898–Oct. 1902

Rear Admiral H. C. TAYLOR, U. S. Navy, Oct. 1902–Oct. 1904

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UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 3 **MARCH, 1919** **Whole No. 193**

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WHAT STEPS IN ORGANIZATION AND TRAINING SHOULD BE TAKEN TO MAINTAIN AND INCREASE THE EFFICIENCY OF THE NAVY AT THE CLOSE OF THE PRESENT WAR?

By Rear Admiral A. C. Dillingham (Retired), U. S. Navy

It is probable that the steps to be taken to maintain and increase the efficiency of the navy at the close of the present war could best be decided by a serious consideration of the lessons taught us and the experiences we have had during the war.

The major principles presented to us with the prosecution of the war, some of which have developed into axioms, are as follows:

The influence of sea power.

The advantages of preparedness for war.

War must be prosecuted with strategic intention.

The necessity for a well-balanced navy, considering the weapons and appliances at the disposal of sea forces.

The necessity for an adequate personnel reserve for the navy in time of peace, *which* shall be *organized* and *trained* ready in all respects for *mobilization*.

Single command.

The importance of a military administration for the conduct of the fleet.

Concerted action.

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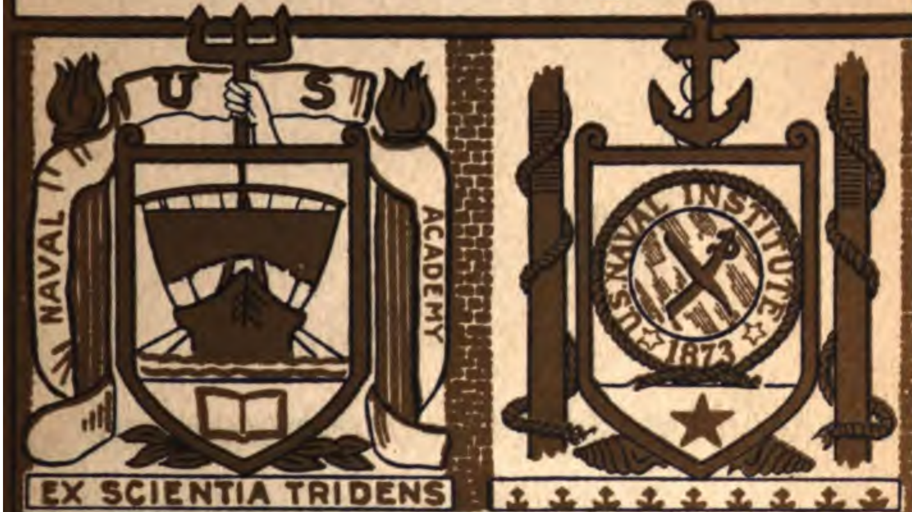
MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.
SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

VOL. 45 MARCH 1919 No. 193

United States Naval Institute
Proceedings



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Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

The advantages derived from preparedness for war have been so conspicuous that we must realize the necessity for preserving the fleet on a war footing and for preserving war habit so far as the absence of actual hostilities will allow. This means that the organization be such that it will not be affected whether we add or subtract units from the active fleet. It means that vessels in reserve at the close of the war shall be actually in reserve, not losing their fighting efficiency, and ready at any moment to take their places in the active fleet, and that the allowed complement of the fleet, active and reserve, be adequate for mobilization at any time.

No amount of preparedness would have allowed us to guard against the piratical use of submarines and other craft, as has been the ruthless, uncivilized practice of our enemies during the present war.

The ruthless murder of women, children and other non-combatants at sea has been a menace not to be anticipated from a civilized government. The settlement for such a violation of all rules of war and civilization can only be made when the terms of peace are considered.

With the advent of the torpedo as a weapon of war and the hydroplane and captive balloon as a necessary facility for long-range fire control and information, the fleet, to be well balanced, must provide against the former and develop to the limit the latter.

Invention has played a conspicuous part in the present war and must receive serious consideration. The aerial bomb is in the progress of development to such an extent as to warrant the assertion that it will be a most important weapon by vessels of the fleet out of range of the enemy's guns, against enemy land defences. The sound detector is susceptible to greater range and becomes indispensable to certain units of the fleet.

The same reasons for a single army under a single commander exist for a single commander for the fleet, and the dependence upon operations for the proper conduct of the fleet is so apparent that no argument is necessary for its continuance in peace. The co-ordination of operations and its representatives afloat has resulted in a singleness of purpose so necessary to obtain desired results, that it must be continued in peace.

Logistics is a problem that has taxed to the utmost not only the interested departments of the navy, but the resources of the country, and we should preserve at the close of the war the methods that have been found most efficient, never with the slightest chance of reverting to pre-war conditions. Logistics bears a most intimate and important relation to preparedness. We must develop and maintain developed, our bases and keep intact the organization for the proper control of the coast, selecting and equipping sub-bases strategically well-located along the coast.

We need most urgently co-ordination of the makers or framers of policy, and the force that is to back that policy, or carry it out. With such co-ordination, strategy and policy will work together in presenting to the navy the reasons for its existence—its mission as a naval force.

The basic principle for all organization is simplicity.

With administration, the authority is centralized in a head of the organization and decentralized to the heads of its units, or parts; these units being such that the results that obtain separately will, when taken together, produce the best results for the whole.

Never before has the administration of the navy been so near ideal as it is to-day, centralized in the Secretary of the Navy and decentralized to the different departments of the navy.

But if the organization of the fleet is not ideal or consistent with the requirements of battle, we will not get the best results from operations, though the administration be ideal.

I claim that the organization of the fleet based upon any other principle than gunnery homogeneity is defective.

In this decentralization we have to do with the administration of the fleet; and necessarily the best organization of the fleet for the purpose of administration, or war, would be a permanent organization as simple as possible, based upon correct principles. The administration of the fleet is centralized in the chief of operations and decentralized to the different departments of operations. Thus, the chief of operations becomes the chief of staff and the heads of his different departments compose the general staff.

Under the direction of the chief of operations, the Atlantic and Pacific fleets are operated to meet the requirements of the political aspects of the world. We thus have the chief of operations assimilating a single command.

If a military organization is based upon a tactical unit, the administration is not affected, whether there is but one or many units; take, for instance, the large number of men at the Great Lakes Station—the unit of the organization is the regiment, so that the administration is the same whether there is but one regiment or 40 regiments.

So with the fleet, if the organization is based upon a tactical unit and is permanent, which it must be if we adhere to the basic principle, the administration is not affected whether we have one unit or many units.

With such an organization based upon gunnery homogeneity, the operation of the fleet needs only the detachment of units for specific service, provided that the units detached are always tactical units, which of necessity, they must be.

With the two fleets, Atlantic and Pacific, if it is necessary to have a force in China, it is only necessary to detail that force from the Pacific fleet—the same with the Atlantic fleet, if it is desired to have a force in Europe or in South America; and again, if, with a League of Nations, an international police is required, it is only necessary that we detail from either fleet, or from both, the units necessary to provide our share of the international force. But for the purposes of our defence and being able to back any policy the government may dictate, we must keep the Atlantic and Pacific fleets in being.

Our navy is essentially a two-ocean navy. As an initial organization, our force shall be divided equally into two parts, to be known as the Atlantic and Pacific fleets. These fleets shall be based upon the Atlantic and Pacific coasts, respectively, and all duty to be performed by the navy shall be performed by units from these fleets. The Asiatic Station is abolished as a separate organization, the duties in the east to be performed by the scout cruisers, or cruiser force of the Pacific fleet, or such other units from the Pacific fleet as may be necessary to meet the requirements of the political aspect of the east at any time.

For strategic purposes, operations will make such disposition of the units of the Atlantic and Pacific fleets as it may see fit, but the initial organization need not be disturbed by the transfer of units from the Pacific to the Atlantic or vice versa. The forces comprising the fleet shall be divided as at present: Battleship force, battle cruiser force, scout cruiser force, destroyer force, submarine force, mine force, train, coast defence force, reserve force.

Let us leave the initial organization, which is an expression of the purpose of our naval force, and consider the requirements of the organization of either fleet, since they must be identical, admitting first that the development of the force depends, primarily, on a sound and permanent tactical organization of ships into fundamental divisions.

Since the climax of efficiency in fleet is to hit the target, and we can only damage the enemy with our guns of sufficient range, ships with similar guns should be grouped together. No other consideration is admissible.

A sound permanent tactical organization of the forces is fundamental, an organization that will not be affected whether we add units, or withdraw them. Let us remember that our defence is one of offence, so that in designing types, if compromise is to be made, it should be made in favor of offence. The tendency to give undue weight to defence is bad in its results, and is not consistent with our needs or traditions. In all modern battles the results desired have been obtained by offence—the guns—and to outrange the enemy has been proved to be an essential advantage.

As the United States may not bring itself to an equality in numbers with the strongest navy, it becomes the duty of the navy to bring and keep its fleet up to such a superior degree of fighting value as at least to stabilize the inequality, and so make numbers.

Fighting value includes such tangible elements as organization, training, discipline, skill, morale, ship efficiency. Skill alone, supported by perfection in maneuvering, can overcome a disadvantage in numbers by a concentrated gunfire on part of the enemy's line, while the other part of the enemy's line is either out of range or contained by part of our force. Thus it would seem that the skill of our flag officers can only find training and

expression in tireless maneuvering of the fleet, and the constant practice of indoctrination. Tactical skilfullness of the fleet can only be obtained through frequent exercises with forces opposing each other. The sole aim of tactical skill is to make numbers; this was illustrated at Nile, Trafalgar and Tsushima.

The tactical unit of organization of the battle line should be the "gunnery unit." The gunnery unit should be the greatest number of ships that can concentrate gunfire on one enemy ship with no loss of ship's destructive fire effect. In the present stage of fire control, it is held that two ships should constitute the gunnery unit. These two ships should be formally under the command of the senior captain—the unit commander—and they should cruise together, work together, overhaul together and play together. Only on the principle of the closest kind of permanent association would it seem possible to drill a gunnery unit to a satisfactory degree of gunnery concentration; each ship must as well be trained to divide its fire on two enemy ships.

The principles of fire distribution to be met by fundamental organization and intensive training are:

First.—That we shall be able to concentrate overwhelming gunfire on a part of the enemy's battle line at shortest range.

Second.—While containing that part of the enemy's line at longest range.

Third.—Keeping, however, every enemy ship within range under our fire, as long as the enemy ship remains in the line.

Necessarily it should follow that the two ships of the gunnery unit should be identical types with identical guns. This principle requires its observance: First, by the creative body (Congress); second, by the designing officers of the navy; and third, by the organizing powers in the navy. To pair a 14-inch gun ship with a 12-inch gun ship would be faulty. To pair a 12-inch 50-caliber gun ship with a 12-inch 45-caliber gun ship would also be faulty, for until we get the long base range-finder so developed as to diminish the necessity for continuous spotting, the ideal gunnery unit would seem to arrive when we group identical ships having interchangeable ammunition, and train them so that one ship will spot for both; either spotting, the other relief.

An organization based on the gunnery unit, which would seem to be permanent and fundamental, is given below:

Ships	Division
Pennsylvania.	
Mississippi, New Mexico, Tennessee, California.	10th Div.
Arizona, Idaho, Nevada, Oklahoma.	9th Div.
New York, Texas, Arkansas, Wyoming.	8th Div.
Florida, Utah, Delaware, North Dakota.	7th Div.
Minnesota, Vermont, South Carolina, Michigan.	6th Div.
Louisiana, Connecticut, Kansas, New Hampshire.	5th Div.
New Jersey, Virginia, Rhode Island, Nebraska.	4th Div.
Georgia, Ohio, Missouri, Maine.	3d Div.
Alabama, Illinois, Wisconsin.	2d Div.
Kearsarge, Kentucky.	1st Div.

These units, some of which are obsolete, exhibit successive construction to produce types that will meet the demands of gunnery and generally present an effort to create tactical units of identical types. Types have changed until we can approach an ideal type and an ideal unit which is based upon gunnery homogeneity.

The organization then to be best must take advantage of these tactical units by placing them so that the result obtained from separate units shall, when taken together, give the best results for the whole fleet.

In the organization suggested, gunnery units and tactical units would be permanent; they are formed of sister ships; divisions are as homogeneous as our fleet will permit; squadrons would not very well be made more homogeneous with the material. Where a ship's position in the organization is vacant owing to

extraordinary navy yard work, the vacancy should remain until the ship rejoins.

A fleet is created by long practice as sea, and this would seem impossible unless there is fundamentally a permanence of tactical organization, including every unit, based on the grouping of sister ships as gunnery units. Without a permanent organization fundamentally sound, we will never get the best results, no matter how intensive the training.

Again homogeneity in maneuvering affected by different underwater bodies must be seriously considered in grouping types. Take, for instance, the *Wyoming*, *New York* and *Nevada* types in turning on a standard diameter. Though these vessels have about the same displacement and speed, the *Wyoming* type in turning will require 17° rudder, whereas the *Nevada* will require but 7° or 8° rudder. Under such circumstances there is grave danger of collision unless the speed of the *Nevada* is changed during the evolution; this is inadmissible. The commanding officer of the *Nevada*, in battle, should not be handicapped by having his attention diverted from his guns by any consideration of tactics.

With respect to the number of ships in a division, the division should combine two or more tactical units. Four ships may always be maneuvered in column; with more than this number the disadvantages cannot be ignored. Concerning the number of divisions in a squadron, our practice of a squadron of two divisions (four tactical units, eight ships) can be asserted the best grouping so long as the tactical unit, limited by powers of fire concentration, remains two ships. And the squadron is generally accepted as the largest number of ships that can be controlled as a unit independently. It is also very generally accepted that independently operated squadrons co-operating under a plan of battle offer the best chance of success in all fleet actions: Trafalgar, Yalu, Tsushima, Jutland.

All our effort should concentrate on learning to co-ordinate in battle our eight ship squadrons acting under independent command and initiative. Discussing the massed fleet obeying one leader versus the fleet co-operating in units, authority holds that the "fleet which works as a whole not only cannot hope to gain

any advantage, but must itself abandon its compactness, if it does not wish to be caught at a disadvantage."

The position of the commander-in-chief in the organization does not seem to be generally agreed upon. Nelson sets, perhaps, the example most profitable to follow. He commanded in person the detachment of his fleet which was designated to handle the most uncertain and most difficult part of the general plan. It would seem that all battles between great concentrations would have to be fought on some such general plan of "containing" a portion of the enemy with a weaker portion of our own fleet, while the stronger detachment of our own fleet had the duty of overwhelming the other portion of the enemy's fleet. The containing operation, usually conducted with an inferior detachment, would appear to be, without doubt, the most difficult, for upon its skilfullness will depend the success of the battle. It does not seem possible to attempt to fix the position of the commander-in-chief.

There is no tactical reason why the commander-in-chief should be in formation, either in battle or in peace. In time of peace, to the contrary, I believe it to be altogether preferable that he be out of formation, flying his flag on a speedy good sea boat with good steaming radius, and large enough to give comfortable accommodations for his entire staff and communication force. This would release a battle unit for fleet work and possibly complete a tactical unit.

Coming to the organization of our destroyer flotilla, the division into groups of six boats seems sound. It would seem evident that the maximum number of destroyers that can attack simultaneously one ship on the same side is three. Thus the unit of three destroyers, which we might call the attack unit, is deduced. A group, therefore, becomes two units (six boats), rendering possible the full power of concentrating the attack of a destroyer group on one capital ship, on both sides. To arrive at the best results the senior attack unit in a destroyer group would operate under the command of the destroyer group commander; the junior attack unit, under the senior destroyer captain in that unit, and his command of his unit at all times should be more than nominal, it would seem, if the best powers of the attack unit are to be developed.

The following is suggested as the result of experience:

Three boats to constitute one attack unit.

Two attack units, six boats, a group. (A group ought to be commanded by a commander.)

Three groups (18 boats) to form a flotilla division. (The division ought to be commanded by a captain, embarked in a scout having as much speed as his destroyers have.)

Three divisions to form a flotilla under a rear admiral. (Three divisions (18 boats each, in all 54 boats) should be the limit of one flag officer's command.)

The organization of the submarine flotilla similarly would doubtless be based on attack units. This merits exhaustive study.

It is intended to express through this article that a fundamentally sound permanent organization is imperative in time of war or peace.

The business or purpose of the reserve fleet and flotillas is to aid or assist the active fleet in war. To this end the vessels in reserve, *like those in the active fleet, must never lose their fighting efficiency*. The reserve force is a part of the active force, and should be under the command of the admiral commander-in-chief of the active force. The organization of the reserve force must be identical with that of the active force; there must be the same co-ordination of the reserve force and active force that there is in the units of either force. All vessels of the reserve force which would add strength and efficiency to the active force must take their place in the battle line upon mobilization; the other vessels of the reserve force lacking tactical requirements of the active force to be employed as the commander-in-chief may direct in coast defence, defence of bases, etc.

The reserve force should be based consistently with the strategy of the active fleet, and should cruise consistently with that strategy, and be trained under the same system as that employed in the active fleet, and in conjunction with that fleet.

If we are to adhere to the axiom that no vessel in the active or reserve fleet shall lose its fighting efficiency, and no other consideration is admissible, it becomes a question as to what shall be the allowed complement of vessels in the reserve, in order to preserve that efficiency.

It has been found, and I believe it to be absolutely necessary that we cruise and be able to have target practice. This necessitates such a complement of a vessel in reserve as will be able to accomplish this.

In our fleet Sims took the destroyers from navy yards to sea, cruised with them, drilled with them at sea, and had target practice with a complement of 50 per cent of their allowed complement. It was not long before he was able to present to the commander-in-chief a force ready for battle to the limit of the physical endurance of its reduced crews, and it is such a condition that should exist with vessels in reserve, no matter what their type. The allowed complement of the fleet must be such as to carry out the requirements of the vessels in reserve, and to be ready for mobilization at any time. Any vessel of the fleet that is not in this condition is not in reserve. It has been suggested that we have first, second, third, etc., reserves, but this is inadmissible; it is a misuse of the term "reserve," for no vessel is in reserve that is not available for mobilization upon an order from operations.

The present law for creating a personnel reserve for the navy, unfortunately, was not enacted years ago. Such a law is intended for time of peace, and such a law at that time would not only create a force organized and trained ready for mobilization, but would increase the size of the continuous service force of the navy. With any scheme for universal training, it must be provided, so far as the navy is concerned, that the forces be organized so that upon mobilization we will be ready for battle.

We can only maintain and increase the efficiency of the navy at the close of the present war by continuing a sound co-ordinate policy with respect to the fleet, the co-ordination of operations and the fleet, the same intensive training which is now going on in the fleet, the preservation of war habit and the reserve force organized and trained ready for mobilization at any moment.

Mobilization can take place at the time when the reserves report for training, and these reserves can be so organized that each man shall have his billet aboard a specific ship, and living in a locality near the base upon which the ship is based, he would have nothing to do but march aboard and take his place.

Under no circumstances must we allow our naval force to drift into peace habits. A peace organization has no place with the

navy. Our whole business should be to profit by the experiences that we have had and the lessons that have been taught us during the present war, remembering how difficult it was for us, so long at peace, so far from the theater of war, to acquire the war habit.

The question of the enlisted personnel is second to no other in importance. No other system than voluntary enlistments will satisfy the conditions of the navy, where we must have a continuous service force, upon which we more or less depend for a permanent organization and which is necessary to provide fighting efficiency.

And there is no organization that I know of so quickly and easily affected by the introduction of an under-trained or untrained element as that of a battleship.

Take, for instance, the *Pennsylvania*—her main batteries representing a potential killing force of nearly a million rifles, and this concentrated on a front, the length of the ship, say 750 feet. The efficient work of this battery depends entirely upon team-work, so that the introduction of an under-trained or untrained element to the ship's company would destroy the team-work and fighting efficiency of the ship.

With the forces ashore, this is entirely different—distributed over a great length of front, the under-trained or untrained element can be distributed so as to not affect the efficiency or organization to any great extent.

If we are to adhere to the axiom that no vessel in the active or reserve fleet shall ever lose its fighting efficiency, it at once becomes a question of not only what shall be the complement of vessels in reserve, but what shall be the method of training the reserve, so that upon mobilization we will least disturb the fighting efficiency of the ship.

If the allowed complement of the ship is not sufficient to maintain that axiom then I would prefer to reduce the force so that the axiom can be, or shall be, maintained.

The present law, creating a personnel reserve for the navy, provides for three months' training in four years. This is insufficient, for, as a matter of fact, we spend one year in bringing a battleship to such a state of efficiency as will permit her to go to record target practice.

At the beginning of the war, we were short of the complement necessary to man the available fighting ships, and the navy was suddenly faced with the necessity for tremendous expansion to meet the demands of war, and the demand for trained men became more acute as the war continued.

The phenomenal results gotten in respect to the personnel through the policy of Operations and the methods adopted by the Bureau of Navigation to carry out this policy may cause us to be optimistic with reference to the personnel, but we must not forget that these results were permissible only because the British Navy controlled the sea.

Proceeding to the Mine Field.

Behind the Smoke Screen. A Submarine Contact.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PLANTING A WAR GARDEN

By CAPTAIN W. T. CLUVERIUS, U. S. Navy

" Ready for getting underway, sir."

Cold, raining, blowing. To meet all three conditions the captain was encased in overcoat, oilskins, and a windproof suit.

" Heave round," he said, as he reached the bridge.

" A bit wetter if anything," casually remarked the commander, " and this chilly breeze means more snow on Ben Wyvis."

" Cheer up," replied the captain, " it's another day."

Since June the sun had been seen all day on two occasions and the wind had never stopped its noise in Cromarty Firth from the time the Yankee Mining Squadron had arrived in Scotch waters. Half the force made port at Invergordon. Here are a naval dockyard and a town grown from 600 to 6000 during the war. Further up the firth, at the base, a thousand enlisted men assembled the " pills of perdition." Anchored below the dockyard, at a respectable distance, are the planters, loaded with 3000 mines and awaiting the word.

Dark at 3.30 in the afternoon and morning colors at 9—so they can be seen—there are still several hours of darkness remaining as the ships, without light or signal, heave up and stand out according to plan, as the Hun says. Time was in the summer when we could read flag signals all night long and it was mighty hard to get our men quiet on those sunshiny nights. There was no watch below. We are content now if we pick up the beacons on the ill-fated *Natal* sunk in the harbor in 1916, and point fair for the gates in the boom defences.

Cromarty Firth is well protected with three nets stretched between the Sutors. On either side, these mountainous cliffs,

bombs. He dives, and in a moment disappears in the deep, windswept water. The escort is recalled, it never leaves us for long. There may have been excitement for 15 minutes, but it was certainly submerged in dark disappointment when that "sub" escaped.

On between bleak, forbidding shores with never a tree in sight, we reach Westray Firth just in time to be caught in a windward tide. In a moment there is commotion. Out of a clear sky and with but little wind, planters and destroyers are picked up by uncrested seas, tossed about on top for a moment, and then dashed broadside into the trough—and the planters are 5000- and 6000-ton ships. It is simply a series of tidal waves in which the waters of the Atlantic Ocean rushing through these narrow channels among the islands encounter the winds of the North Sea which resent such intrusion—and there is rough-house for fair.

Sea after sea calmly rolls aboard forward and sweeps aft before you can say Oh! or close a hatch. Our beautiful formation has now the appearance of a set of lead soldiers thrown hastily back into their box. It is go as you please to keep clear. The destroyers suffer cruelly, but they rise gamely after each eclipse, with seas streaming from their decks, and plunge along with us.

In an hour we are through it and we know the moment the Atlantic gets us. We make certain of the security of the mines on the tracks as we labor around Noup Head, which frowns high above us, covered with mist and spray. Our gyroscopic compasses cannot stand that racket, they always go out at Noup Head. It is a *dour* spot at best.

Midnight, and Fair Isle, the guiding star for friend and foe, comes into sight and leads us back into the North Sea. As we square away for the mining point, over goes the taut wire from the rear ships.

Taut wire navigation is a great institution. Each ship has a machine carrying a dial and a renewable spool wound with 120 miles of piano wire. Tie the end of the wire to a grate bar, over it goes, and there you are. A mile's a mile and no question about it. When we first heard of this style of navigating one man said it would be too much trouble to reel up the wire again. Another thought it would simplify matters a great deal. "Tie one

end to the pier as you go out and you are bound to get back, fog or no fog," he said.

Standing eastward for 50 miles we sight the *Primrose*—a British war-type of auxiliary built to do anything—standing by her marker buoy. To the northward on the smoky horizon is cruising the screen, a squadron of battleships and another of light cruisers attached to the Grand Fleet. Sometimes our own Sixth Battle Squadron supported us while we worked, and the sight of their cage-masts was cheery and most homelike. To the south of us is the barrage. It finally stretched across the North Sea, 200 miles and more between the Orkneys and the southern Norwegian coast. Thirty miles wide is this barrier, destined to trap the "sub" at any depth and to discourage any attempts of the High Seas Fleet or the Hun raiders to get to sea.

The barrage is made up of several systems of mine fields, each averaging 2000 yards in width, extending east and west across the area. Each planting of our force meant 55 miles of a system in five continuous fences, or lines of mines, laid at different levels.

This is the way it is done:

In column, the planters round the *Primrose,* who picks up her buoy and away she goes to the northward with the escort—that is our safe side just now. "Ships right 90" into mining formation. A single flag from the *San Francisco* and a "PLANT" flashed on the bridge telegraph and the planting begins.

Steaming in line abreast 10 big ships disgorge a mine every 15 seconds, breaking joints with each other so as to leave no holes. Some of the planters have three deck-loads of mines and others two. This means elevators to the launching deck. Two of the ships have only one mine deck with mines on four tracks. The installations are similar. The mine cases are secured to their anchors which are fitted with wheels. The mines complete, with final adjustments made, are moved aft along the tracks by traction winches to the traps and thence overboard by signal from the mine booth. The speed is regulated throughout; no noise, no orders. Signals flash along the tracks on the sentry indicators. The mining crews work as gun's crews, like clockwork. Nothing simpler, as down the line of planters is seen the steady splash, splash, astern. The speed is usually 12 knots, though satisfactory planting has been done by the faster ships at 17 knots in a seaway. Woe betide a planter if she should stop while planting in that

company! And if it shuts in thick, a careful course is more than ever essential.

For nearly five hours the operation goes on, each ship taking up the planting as another leaves off. Darkness descends, but your neighbor shows you no "light in the window." He is just a black mass. The compass is the thing now. A flash from a blinker tube from ship to ship and the job is done. We go "ships right" off the field and take up the route formation for home.

Spirits are lighter, speeds are better, and the 200-mile run to port is a jaunt. Let the "sub" on watch in The Hole have a go at us now, who cares? But he will not; he is not a sport.

At early daylight we part company off Cromarty Whistler and the race for assigned berths is on.

If it has been your pleasure—and duty—to be on the bridge for two days and nights on end, chilled, soaked, muscle-sore, and hungry, and your ship gets a line to the buoy, can you a second later be in your bunk, hunger forgotten, the world forgotten, fast asleep?

You know what I mean!

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE "TRICKLING CHARGE" AS APPLIED TO LEAD-ACID STORAGE BATTERIES OF THE NAVAL SERVICE

By Lieut. Commander Lucius C. Dunn, U. S. Navy

The chemical action which manifests itself in the storage battery cell and the normal cycle of life of this cell may be said to be analogous in many respects to that of the human body; that is, there is a constant wearing away and building up of tissues with a gradual lapse into debility and old age after a more or less definite period of activity. Moreover, just as the human body requires food, water, exercise and a reasonable amount of care and attention to preserve it in a vigorous, healthy condition for performing its characteristic functions of life, so does the storage battery also require, in effect, food, water, exercise and a reasonable amount of attention to enable it to efficiently perform its designated functions.

The application of the storage battery to the art of electrical engineering in our naval service is daily increasing at an unprecedented rate, so much so, in fact, that there is now a storage battery stand-by installation designed for practically every electrical circuit on board ship, and, in many instances, the storage battery constitutes the prime source of power for some of those circuits; also, in addition to the application of the storage battery on board ship, it is extensively used for similar purposes on shore stations and in the aviation branch of our service.

Therefore, in order that these storage batteries may receive the proper care and attention which they deserve, thereby insuring that they will efficiently perform the various duties required of them when called upon, it is essential that our personnel

charged with the operation, care and maintenance of these batteries duly appreciate the foregoing analogy and bear in mind that there is a certain amount of "human nature" even in a storage battery. This done, it is believed that the sphere of usefulness of the storage battery will be further increased and that it will prove a stepping-stone to even greater achievements in the now rapidly developing art of electrical engineering in our naval service.

A very necessary routine practice in the care and maintenance of the storage batteries designed for the various duties of our naval service, and a practice which should be encouraged to the end that these batteries may always be maintained in the prime of condition and ready for instant duty, is known as the "trickling charge," and it is the purpose of this article to attempt an explanation of the salient principles upon which this practice is based, as well as to describe the methods by which it may be applied to the storage batteries under regular service operating conditions on board ship and in the general naval service.

"TRICKLING CHARGE" DEFINED

It is well at this point to define the term "trickling charge"; it may be defined as follows:

> When the storage battery is connected across the electrical supply mains or bus-bars and the conditions obtain wherein the battery is at all times receiving just enough current to counteract local action and thus maintain it in a full charged condition, the storage battery is said to be receiving a "trickling charge." A fraction of an ampere only, the amount of which depends upon the size of the battery, is required for this "trickling charge," and, aside from the advantages obtained as a result of counteracting local action in the cell, the battery at all times has its entire capacity available for instant use when required.

In other words, the small amount of charging current passing or "trickling" through the battery is just sufficient to reduce the small layer of lead-sulphate ($PbSO_4$) normally formed in the plates as a result of the local action incident to the "internal or self-discharge" of the battery, and, furthermore, this small amount of charging current is not sufficient to cause any deleteri-

ous effects through heating or undue gassing of the battery. In fact, when the "trickling charge" is properly conducted practically no rise in temperature is apparent, and there is only a slight amount of gas evolved, if any.

In order that a thorough understanding may be had as to the object of the "trickling charge," it is well in the beginning to consider the prime constituents of the lead-acid storage battery cell and the fundamental equation of the reactions which take place in this cell during the cycle of charge and discharge.

FUNDAMENTAL EQUATION OF THE LEAD-ACID STORAGE BATTERY CELL

The active constituents of the lead-acid storage battery cell are as follows:

(a) Positive plate; lead-peroxide (PbO_2), which is of a velvety "chocolate" brown color.

(b) Negative plate; finely divided sponge lead (Pb), which is of a "battleship" gray color.

(c) Electrolyte; dilute sulphuric acid (H_2SO_4), consisting of chemically pure sulphuric acid diluted with pure distilled water.

The generally accepted fundamental equation for the normal chemical action which takes place in this cell may be thus indicated as follows:

$Pb + PbO_2 + 2H_2SO_4$; cell in charged condition.

$2PbSO_4 + 2H_2O$; cell in discharged condition.

Therefore, in combining the above, the fundamental equation of the complete reaction is written as follows:

$$Pb + PbO_2 + 2H_2SO_4 \ (\rightleftarrows) \ 2PbSO_4 + 2H_2O.$$

In other words, the conventional sign ($\rightleftarrows$) indicates that this reaction is completely reversible; that is, reading this equation from left to right ($\rightarrow$) denotes the action which takes place during discharge of the cell, and reading from right to left ($\leftarrow$), that which takes place during charge.

It is, therefore, apparent from the above equation that during discharge the acid radical, SO_4, of the electrolyte combines with the active materials of the positive and negative plates and converts both of these plates into lead-sulphate ($PbSO_4$). More-

over, during charge the lead-sulphate is reduced by the charging current and the acid radical returned to the electrolyte, the active materials of both plates being accordingly restored to their original states; that is, to sponge lead and lead-peroxide.

SELF-DISCHARGE OF AN IDLE BATTERY

It is an established fact that if a fully charged or a partially charged battery is allowed to stand idle long enough it will eventually become completely discharged of its own accord. This is manifested by a reduction in the cell voltage, a drop in the specific gravity of the electrolyte and the formation of lead-sulphate in the positive and negative plates. In other words, although the circuit connecting the terminals of the battery has not been closed during the idle period and, consequently, no current drawn from the battery, the acid radical of the electrolyte has nevertheless combined with the active materials of both sets of plates, converting them into lead-sulphate in the same manner as though the battery had been subjected to a regular useful service discharge.

A fully charged battery will completely discharge itself in approximately 100 days if allowed to remain idle without receiving a freshening charge during this period. However, the degree of acid concentration in the electrolyte and the temperature to which the battery is subjected are governing factors in the time element required for a battery to become discharged through self-discharge, high acid concentration and high surrounding temperatures tending to lessen the time element necessary for a complete self-discharge as outlined above.

FACTORS WHICH PRODUCE SELF-DISCHARGE

There are several factors which are in various degrees responsible for the internal or self-discharge which takes place in an idle storage battery. These factors, when considered either individually or collectively, are, in battery parlance, usually referred to under the general term "local action." Chief among these several factors may be stated the following:

1. Impurities in the electrolyte.
2. Impurities in the materials composing the grids, and defective grid-casting.

3. Local couples formed in the manufacture of the positive plates.
4. Local couples formed in the manufacture of the negative plates.
5. Leakage of current between the cell terminals as a result of moisture grounds, etc.

Each of the above factors may be briefly commented upon as follows:

Impurities in the Electrolyte.—As a general rule any metallic impurities present in the electrolyte will cause a loss of charge at the negative plates. During charge such metallic impurities are deposited upon the negative plates where they form innumerable local couples with the active materials of these plates, with the consequent result that in the presence of the electrolyte discharge takes place, thus liberating hydrogen at the negative plates and with a loss of charge at these plates.

Such metallic impurities include antimony, arsenic, copper, iron, platinum and tin. Iron is in general the most active and destructive of the above-mentioned impurities, for due to the fact that the ions of this metal can exist in two different stages of oxidation, each stage of which is capable of being converted from one to the other, these ions continually oscillate from one group of plates to the other, when the cell is placed on open circuit, thus causing a consequent loss of charge at each group.

It requires only a comparatively small amount of iron in a cell to completely discharge it in a very short while when the cell is left on open circuit. Therefore, great care should be exercised when operating the storage battery that iron is prevented from entering the cell, such as through using electrolyte or water which contains iron, dropping into the cell iron nuts, bolts, washers, nails, tools, etc., or through any other cause. Furthermore, all iron which enters a cell from time to time is cumulative in effect, as none of this metal is lost by electrolytic decomposition or liberated in a gaseous state, as is the case with certain other impurities.

Impurities in the Materials Composing the Grids, and Defective Grid-Casting.—The alloy used in casting the grids of the storage battery cell consists of lead and antimony. If these metals are not refined to a very high degree the other metallic impurities contained will set up small local couples in the

presence of the electrolyte, thus causing a loss of charge of the plates. Also, if the lead-antimony alloy is not a homogeneous mixture or if there are segregations of pure antimony and pure lead in spots with blow-holes or shrinkage cracks in the casting as a result of improper cooling or insufficient mixing of the alloy before pouring into the molds, other local couples are formed, which accounts for a further loss of charge of the plates.

Local Couples Formed in the Manufacture of Positive Plates.—As outlined above, the grids are composed of lead-antimony alloy, whereas the active material of the positive plates consists of lead-peroxide. We thus have a couple formed by the lead-peroxide and the grid in the presence of the electrolyte, which results in a certain amount of discharge of the positive plate, the amount of which depends upon the surface contact area between the positive active material and the grid. However, the discharge from this cause is of comparatively short duration, since a layer of lead-sulphate is eventually formed between the grid and the active material of the positive plate, thus forming an insulating medium which prevents further discharge.

Also, another source of internal or self-discharge of the positive plates, especially in the Planté type, is the failure to remove all of the forming agents which were used in forming the plates. If these plates are not thoroughly cleared of all such forming agents, the loss of charge from this cause is likely to prove quite appreciable in amount.

Local Couples Formed in the Manufacture of Negative Plates.—As in the case of the positive plates, we have in the negative plates local couples formed by the lead-antimony alloy grid in contact with the sponge lead active material, and in the presence of the electrolyte a certain amount of discharge takes place in the negative plates from this cause. Also, as was described in the preceding paragraph relating to the positive plates, a thin insulating layer of lead-sulphate is similarly formed between the negative grid and the active material of this plate, thus preventing a further loss of charge from this cause.

Another loss of charge at the negative plate is due to the local action which takes place between the various materials used for obtaining porosity, increasing conductivity and the various expanders used in the manufacture of these plates.

Leakage of Current Between Cell Terminals.—Although, properly speaking, loss of discharge from this cause is not due to local action in the strict meaning of the term, it is nevertheless included here since it accounts for quite an appreciable amount of loss of charge in an idle storage battery cell if such a condition is allowed to exist sufficiently long without rectifying it; in fact, the loss of discharge through this cause is in some cases equal to, if not greater than, the combined loss of charge due to the other factors outlined above, provided the leakage of current between the terminals is of protracted duration.

METHOD OF CONDUCTING "TRICKLING CHARGE"

Having considered the effects of the various factors of local action in producing self-discharge of the idle storage battery cell, the object of the "trickling charge" in reducing to a minimum the effects of this local action, as well as maintaining the battery in a fully charged, healthy condition is, therefore, readily apparent.

As was explained in defining the term "trickling charge" in the early part of this article, only a fraction of an ampere of current is sufficient to counteract this local action, the amount of the current depending upon the type of the battery in respect to the size and the number of plates installed in the cells.

LAMP-BANK METHOD

A very satisfactory and simple method of conducting the "trickling charge" and one which is very conveniently applied on board ship is known as the Lamp-Bank Method, and consists in connecting lamp-banks in series with the battery and the charging busses of the ship's main supply lines, the number of lamps used depending upon the following:

(a) Type of battery; size and number of plates in the cells.

(b) Number of cells in the battery.

(c) Voltage of the charging busses.

The function of the lamp-banks is that of a resistance to absorb the excess voltage in the main charging line over that required for the small amount of "trickling charge" current passing through the battery.

Fig. 1 contains an illustration of the equipment and necessary connections required for conducting a "trickling charge" by the lamp-bank method on navy type storage batteries.

The lamp-banks connected in series with the battery and the main charging busses are plainly shown in this illustration, as is also the double-pole snap-switch used for cutting on or off the "trickling charge" current, as desired. The direction of the current in passing through the battery on charge is as indicated by the arrows in the drawing. In this regard, as in all other cases of charging storage batteries, it is essential that only direct current be used for this purpose and that the positive terminal of the battery be connected to the positive charging bus and the negative terminal of the battery to the negative bus. To do otherwise will result in serious harm to the battery.

In conducting the "trickling charge" by the lamp-bank method, the life of the lamps will be increased if the arrangement of the lamp-banks is such as to reduce the voltage sufficiently to cause the lamps to burn at a low incandescence. Also, as a general rule, on account of their high efficiency and long life, tungsten filament lamps should be used, if obtainable, in preference to carbon filament lamps, as they afford a finer degree of current and voltage regulation than the carbon filament lamps. However, if the conditions are such that it is not practicable to use tungsten filament lamps, carbon filament lamps may be used.

The advantage in using lamp-banks as a resistance, instead of using regular commercial resistance units in conjunction with a low-reading ammeter, rests in the fact that lamp-banks at all times afford a reliable visual indication that current is "trickling" through the battery, whereas, the needle of the ammeter does not present so striking an indication of the charging current; in other words, as long as the lights are burning it is definitely known that current is passing through the battery, and anybody on watch in the vicinity, whether he be a coal-passer or an ordinary seaman, can tell when the charging current is on or off.

At navy yards, shore stations and regular battery service stations, where the organization is such that someone is in constant attendance with the storage batteries on charge, commercial resistance units may well be used in connection with ammeters and voltmeters, as at such places proper facilities are at hand for using at all times accurately calibrated instruments, etc.

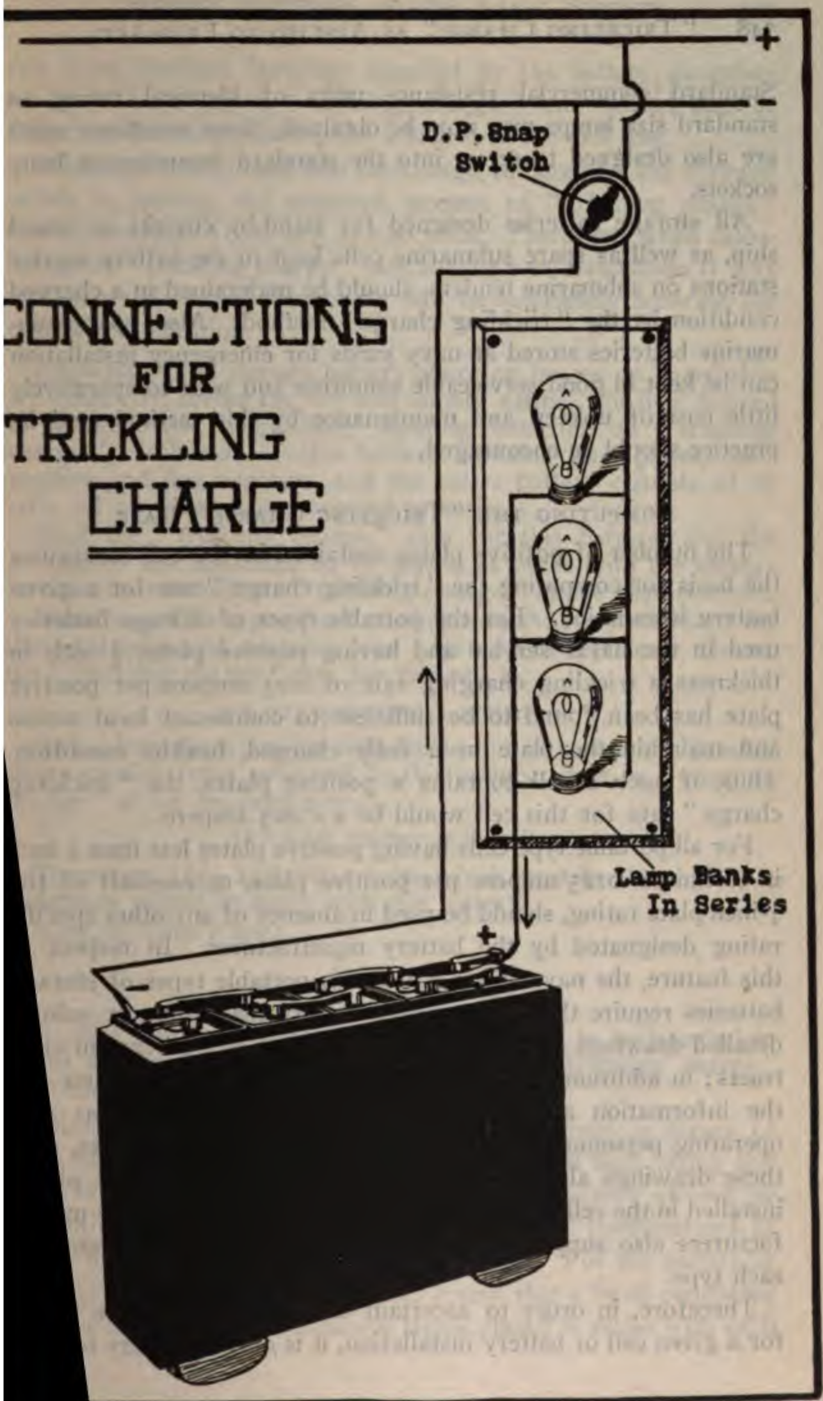

+
-
D.P. Snap
Switch
CONNECTIONS
FOR
TRICKLING
CHARGE
Lamp Banks
In Series
+
-

Fig. 1.

Standard commercial resistance units of identical rating as standard size lamps may now be obtained; these resistance units are also designed to screw into the standard incandescent lamp sockets.

All storage batteries designed for stand-by circuits on board ship, as well as spare submarine cells kept in the battery service stations on submarine tenders, should be maintained in a charged condition by the "trickling charge" method. Also, spare submarine batteries stored at navy yards for emergency installation can be kept in good serviceable condition and with comparatively little cost of upkeep and maintenance by this method, and its practice should be encouraged.

COMPUTING THE "TRICKLING CHARGE" RATE

The number of positive plates contained in the cell constitutes the basis for computing the "trickling charge" rate for a given battery installation. For the portable types of storage batteries used in the naval service and having positive plates $\frac{1}{4}$ inch in thickness a trickling charging rate of .025 ampere per positive plate has been found to be sufficient to counteract local action and maintain the plate in a fully charged, healthy condition. Thus, if such a cell contains n positive plates, the "trickling charge" rate for this cell would be $n \times .025$ ampere.

For all portable type cells having positive plates less than $\frac{1}{4}$ inch in thickness .0125 ampere per positive plate, or one-half of the $\frac{1}{4}$-inch plate rating, should be used in absence of any other specific rating designated by the battery manufacturer. In respect to this feature, the navy specifications for portable types of storage batteries require that each storage battery manufacturer submit detailed drawings of every type cell supplied on government contracts; in addition to containing detailed drawings of parts for the information and use of the battery service stations and operating personnel in ordering spare parts, making repairs, etc., these drawings also specify the number and size of the plates installed in the cells. For submarine type cells the battery manufacturers also supply the required "trickling charge" rate for each type.

Therefore, in order to ascertain the "trickling charge" rate for a given cell or battery installation, it is only necessary to con-

sult these detailed drawings supplied by the battery manufacturers. The required "trickling charge" rate should also be found on the metal name-plate attached to the cell tray.

It has also been found that the charge voltage of a cell through which is passing the required amount of "trickling charge" current averages from 2.15 to 2.20 volts. Therefore, when calculating the "trickling charge" rate for a given installation if 2.15 volts per cell is used the results will be sufficiently accurate for practical application.

Example.—The storage battery charging busses on board ship are connected across the 115-volt supply mains, and it is desired to place a set of auxiliary lighting batteries on "trickling charge"; each cell of this battery contains nine plates, four positive and five negative, and the entire battery consists of 12 cells, all of which are connected in series.

Find the "trickling charge" rate for this battery, and the amount of the resistance to be placed in series with the battery in order to conduct the "trickling charge" at the required rate.

Solution.—This type of cell conforms to the navy standard for these batteries and contains four ¼-inch positive plates. Hence, the "trickling charge" rate for this cell is:

$$4 \times .025 \text{ ampere} = .1 \text{ ampere.}$$

Also, since there are 12 cells connected in series, the counter electromotive force produced by this battery when on "trickling charge" at the required rate is:

$$12 \times 2.15 \text{ volts} = 25.8 \text{ volts.}$$

Therefore, $115 - 25.8 = 89.2$ volts, which must be absorbed by a resistance placed in series with this battery.

Now, by Ohm's law:

$$C = \frac{E}{R}, \text{ or } .1 = \frac{89.2}{R}.$$

R=892 ohms, the amount of the resistance to be inserted in series with the battery in order to allow a "trickling charge" of .1 ampere to pass through the battery.

Therefore, in order to translate this resistance in terms of lamp-banks it is only necessary to select lamps of such rating and to so combine them that the value of the resistance offered by the entire lamp-bank will be 892 ohms; various combinations of lamps may be utilized for such a lamp-bank. For the particular problem outlined above it has been found that a bank consisting of three 25-watt metallic filament lamps placed in series with each

other, and this lamp-bank in turn placed in series with the battery, will allow a "trickling charge" of .1 ampere to pass through the battery.

GASSING AND VENTILATION OF BATTERIES DURING "TRICKLING CHARGE" AND CARE OF COMPARTMENT IN WHICH THEY ARE LOCATED

Although, as has been stated, when the "trickling charge" is properly conducted, the amount of gas evolved from the storage batteries is relatively small, yet, as a precaution during this charge, the trays of these batteries should be left uncovered and the compartment in which they are located should also be well ventilated, periodically, at least, in order that any gas which is evolved will be dissipated before an explosive mixture is formed.

In this regard, tests conducted are conclusive that a 4 per cent mixture of hydrogen in air is dangerous and it is the established policy in operating storage batteries requiring forced ventilation in our service, such as the submarine types, to design the ventilating apparatus on a basis of sufficient capacity to keep the amount of hydrogen present in the air at any instant below 2 per cent, thus insuring a substantial factor of safety in the operation of these batteries.

The compartment in which the batteries are located should be kept free from sweating and otherwise as dry as possible in order to reduce the likelihood of moisture grounds occurring around the batteries. The tops of the cells, sides and tops of the trays, stowage racks, etc., should also be kept dry and free from acid spray, as in addition to causing leakage between the cell terminals and other such grounds, the cell trays and other woodwork around the batteries will become acid soaked, which will eventually result in rotting of the woodwork of the trays and other parts. It is good practice to give the cell trays and other woodwork around the batteries a coating of asphaltum or other acid-resisting paint periodically as necessary. All metal work in the compartment in which the batteries are installed should also be coated with acid-resisting paint to protect them from the corrosive action of the acid fumes and spray given off from the batteries. It is essential to successful operation of the batteries

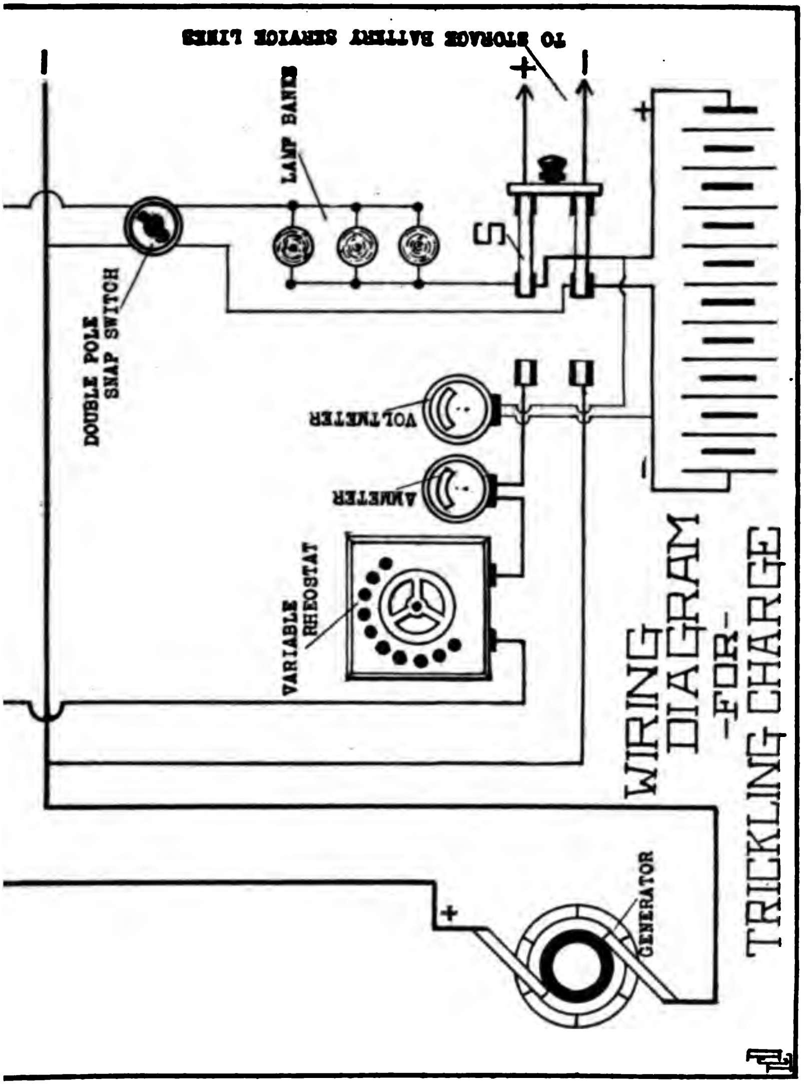

TO STORAGE BATTERY SERVICE LINES
LAMP BANKS
DOUBLE POLE SNAP SWITCH
S
VOLTMETER
AMMETER
VARIABLE RHEOSTAT
GENERATOR
WIRING DIAGRAM -FOR- TRICKLING CHARGE

FIG. 2.

that the compartment be kept clean and no metals, tools or other materials stored around or on top of the batteries.

WATERING BATTERY AND ROUTINE OVERCHARGE

In conducting the "trickling charge," the cells should be watered regularly with pure distilled or other approved battery water to replace that lost in evaporation. Under no conditions should acid be added to replace evaporation.

Also, for best results, the battery should, as a routine practice, be given an "overcharge" at the prescribed "finishing" rate at least once a month in order to thoroughly mix the added water with the electrolyte and to prevent the injurious effects of stratification of the acid in the electrolyte. In this regard, cells which are allowed to remain inactive for protracted periods, that is. not being subjected to regular cycles of charge and discharge, are subject to this acid stratification in the electrolyte, in that the heavier and more concentrated acid tends to settle to the bottom of the cell with the result that effect of local action on the plates is more pronounced in the lower part of the cell. Although, as has been pointed out, the "trickling charge" is designed to reduce the effect of local action to a minimum, the "trickling charge" rate is not sufficient to produce enough gassing in the cell to stir up or agitate the electrolyte, and for this reason the periodic overcharge is helpful in dissipating any tendency to stratification of the acid.

The duration of this overcharge should be sufficiently long to insure that a maximum specific gravity reading has been obtained, as shown by four successive readings taken at equal intervals for a period of one hour. Such a maximum gravity reading insures that practically all acid has been driven out of the plates, if the cells have received the proper attention during previous operation.

There is shown in Fig. 2 a composite wiring diagram of the complete equipment required for charging or discharging a set of storage batteries on board ship. In addition to the "trickling charge" equipment which has already been described, this diagram also includes the necessary connections and equipment for giving the storage battery a normal charge, and "overcharge," as well as the connections for discharging the battery through the discharge service lines.

It will be noted in this diagram that the regular charging equipment consists of a variable rheostat, connected in circuit with the main current supply lines, for regulating the charging current to correspond with the prescribed "starting" and "finishing" rates for the particular types of battery used in the installation. Connections to ammeter and voltmeter are also shown in the diagram.

Charging and discharging are effected by means of the double-pole double-throw switch *S*, which may be closed on either side of the circuit, as desired. Manifestly, when discharging the battery, the double-pole snap-switch on the "trickling charge" circuit should be in the "open" position; also, when the battery is receiving a "trickling charge" switch *S* should be thrown in the "open" position.

In conclusion it is safe to say that the storage battery has come to stay in our naval service, and the "trickling charge" will accordingly occupy a prominent place in the operation, care and maintenance of these batteries.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ON THE HISTORY OF DISCIPLINE IN THE NAVY

By Charles Richard Williams

Lecture I

THE SOURCE OF THE "ARTICLES FOR THE GOVERNMENT OF THE NAVY OF THE UNITED STATES"

The fundamental law on which the American Navy rests is the "Articles for the Government of the Navy of the United States." How important familiarity with these articles on the part of every one in the navy is regarded by the Government, is shown by the fact that the articles are required "to be hung up in some public part of the ship and read once a month to the ship's company." The articles, in fact, are the charter of the rights, the duties, the obligations, and the privileges of the officers and men in the navy—their Bible, so to say. Or we may think of the articles as the constitution of the navy, the expression of the essential governing principles in harmony with which all the innumerable rules and regulations, necessary for the direction and discipline of men engaged in the many and various duties of a modern navy, and for insuring the orderly and efficient conduct and control of naval activities, have been formulated and established.

The larger and more complex any human institution or enterprise becomes, the greater the need of regulation, of defining the precise functions, duties, and rights of the various elements composing and conducting it. The rules that were sufficient to govern the navy when it was composed entirely of sailing vessels of different classes, none very large according to modern ideas, would be entirely inadequate under present conditions, when steam and electricity and radio communication, when armor plate, long-range guns, and high explosives, when torpedoes, airplanes, and submarines have brought about undreamed-of prob-

lems and made necessary many new varieties of specialized knowledge and skill. The modern great warship is as different from the warship of a hundred years ago as the Waldorf-Astoria from the old Astor House, or as the Baldwin Locomotive Works from an old-time wagon factory. No wonder the rules and regulations of the navy, which in 1830 could be printed in a thin little volume, now make a ponderous tome of hundreds of pages. They have simply kept pace with the enormous changes in construction and equipment, in methods and activities, and the corresponding increase and variety of functions and duties.

Meanwhile, however, the fundamental law, the constitution, as I have called it, of the navy has remained in its essential quality much the same as at the very beginning of an American navy. The present articles are more numerous and more detailed, the arrangement of them is more orderly and logical, and they display greater precision in language and definition; but there are few subjects dealt with in the very first articles that are not treated in the present articles, and in many instances in practically the same language.

The first American articles were adopted by the Continental Congress in November, 1775, more than seven months before the Declaration of Independence. They were styled "Rules for the Regulation of the Navy of the United Colonies." Every commander of a naval vessel received copies and was required to post them in "public places of the ship" and cause them to be "read to the ship's company once a month." The new navy was directed and administered by a committee of Congress, the most efficient member of which was Robert Morris. The committee, in assigning officers to duty, repeatedly enjoined upon them the duty of strictly obeying the articles, and usually ended its letters of instruction with some such injunction as this: "Use your people well, but preserve strict discipline; treat prisoners, if any you make, with humanity; and in all things be duly attentive to the honor and interest of America." These words are taken from a letter of August 23, 1776, to Lieutenant John Baldwin, commander of the schoonor *Wasp*, one of the earliest letters of the committee still preserved in the Library of Congress. Similar injunctions are found in many other letters. At the same time, commanders were encouraged and exhorted to be bold. A letter of November 1, 1776, to Captain Elisha

Warren, of the continental sloop *Fly*, urges: "Although we recommend your taking good care of your vessel and people, yet we should deem it more praiseworthy in an officer to lose his vessel in a bold enterprise than to lose a good prize by too timid a conduct." These quotations afford a very noble impression of the spirit of discipline, humanity, and enterprise which the Fathers desired should permeate and characterize the Continental Navy. They would be entirely appropriate admonitions to naval officers at any time.

The ships of the Continental Navy, few as they were, and often poorly equipped and inefficiently manned, rendered an indispensable service in the struggle for independence. If we add to these ships the vessels commissioned by the individual Colonies and the multitude of authorized privateers, probably more Americans fought during the Revolutionary War on sea than on land, and without their efforts, it is safe to say either that the Colonies would have failed to win their cause or that the war would have been greatly prolonged.

At the end of the war the navy simply began to fade away, the emergency for which it was created having passed. By 1785 the last ship of the fleet had been disposed of. In the establishment of the new Government of the United States, no provision was made for the creation of a navy. It was not till 1798, when the activities of French privateers in the West Indies stirred the country and Congress to the need for defensive action and reprisal, that a Naval Department was formed and a Secretary of the Navy was added to the Cabinet. That year marks the beginning of the navy of the United States. The "Articles for the Government of the Navy" which were then adopted were based on the articles of 1775; and the present articles, by numerous modifications, additions, and amendments, to meet the changing conditions and requirements of the vastly enlarged service, have been developed out of the articles of 1798.

Thus, the general principles of discipline controlling the officers and men of the American Navy, from the far-off days of the little sailing vessels of the Revolutionary struggle down to the present epoch of gigantic superdreadnoughts, have had continuous life and force. It ought to give any young man entering the naval service a certain thrill of elation that he becomes the heir of a long and glorious tradition, and that, in studying the

articles controlling that service, he is familiarizing himself with regulations some of which, couched in almost exactly the same words, were obeyed by John Paul Jones and were read to the ship's company of the *Bonhomme Richard*.

The "Rules for the Regulation of the Navy of the United Colonies," the source or basis, as I have said, of all subsequent "Articles for the Government of the Navy," were adopted by the Continental Congress on November 28, 1775. They had been framed or compiled by John Adams, always a devoted and intelligent advocate of a navy. He had had no maritime experience, but he was a very eminent lawyer and, doubtless, in his legal practice at the important port of Boston, had had occasion to learn much of the laws of the sea. At any rate, he had great good sense and knew where to look for information and precedents. Of course, he did not attempt to frame a code of rules out of hand. That would have been quite impossible for any landsman, however wise and learned, to accomplish. The result of such an attempt could only have been ridiculous. Indeed, laws of any sort are seldom made that way. They usually are based upon or grow out of previous enactments or court interpretations; or they put into formal expression well-established rules of conduct that have almost gained the force of law; or they extend the application of accepted legal principles to correct new abuses or to meet novel conditions.

Very naturally, therefore, John Adams had recourse to the articles governing the British Navy—the navy up to that time of the American Colonies as much as of the British Islands. Many Americans had served in the British Navy; British maritime law, like the common law, was the law of the Colonies. British naval law and traditions must have been familiar, in a general way at least, to most of the seafaring population of America—the population from which the officers and men of the new navy were to be drawn. In the absence of any legislation by the Continental Congress, therefore, the officers of American war vessels would, doubtless, as a matter of course have followed the rules and precedents of the British service. What John Adams did was to adopt from the British articles the rules that he considered essential, modifying them where necessary to meet American exigencies or ideas. John Paul Jones is sometimes spoken of as the father of the American

Navy. But John Adams was certainly the father of it on its administrative side. And it must not be forgotten that it was under his administration, as President, that the Navy Department was created and the foundation of the United States Navy was laid.

Considered with reference to the needs and conditions of the time of their promulgation, the articles of 1775 may be characterized as reasonably comprehensive and satisfactory. If fairly obeyed and administered, according to their spirit as well as their letter, they were sufficient to define the rights and duties of officers, to secure fair and just treatment of the men, and to procure honest and faithful service for the Government. The articles consist of something more than forty paragraphs. All together they fill not much more than a third of the space occupied by the present articles.

They contain certain paragraphs as to the food and pay of the men that now have no place in the fundamental law of the navy. The food allowance for each day is precisely specified. For example: "Sunday—one pound bread, one pound beef, one pound potatoes or turnips." "Wednesday—one pound bread, two ounces butter, four ounces cheese, and one-half pint of rice." Beef and pork alternated as the meat ration, and fresh fish was served in addition, when the ship happened to be "in such places where fish is to be had," and the men detailed by the captain to go fishing had good luck. Moreover, every man was entitled to "half a pint of rum every day, and discretionary allowance on extra duty and in time of engagement." It is easy to imagine what the Jackies meant when they spoke of a generous-spirited officer as a man of fine discretion! The allowance of rum was continued until 1862. In lieu of it, the pay of the Jackies was slightly increased. This mitigated the Government's offense, but did not completely appease the thirsty subjects of it. They had a song at the time reflecting their state of mind, the refrain of which was:

> "They raised our pay six cents a day,
> But stopped our grog forever!"

The salaries fixed by the articles were not such as could exactly be described as munificent, even for the simpler and more frugal days of the last quarter of the eighteenth century. Captains received thirty-two dollars a month; surgeons, twenty-one

and one-third dollars; lieutenants, masters, and chaplains, twenty; minor officers from fifteen to eight; and able seamen, six and two-third dollars a month. Perhaps it is not to be wondered at, therefore, that there was often great difficulty in getting sufficient crews, that captains were constantly exhorted by the Marine Committee to use their best endeavor to enlist men at any West Indian port they visited or from the prizes they might take, and that men of low character and little or no sea experience sometimes formed the majority of a ship's company. Service on board privateers was more attractive to most able seamen as promising less hazard and larger pecuniary rewards. It is only fair to say, however, that it was the expectation of Congress and the hope of the men on entering the naval service, that the official salaries should be substantially supplemented by the capture of prizes. And this expectation and hope were in very many cases justified by the event. In the two years, 1776 and 1777, for example, ships of the Continental Navy captured more than one hundred and twenty prizes.

Taken as a whole, the articles of 1775 are more general in their terms than the present articles. They do not go into such detail either in defining the duties of officers or in specifying the various possible crimes, misdemeanors, and breaches of discipline that might occur on shipboard. But certain specifications are most interesting. The third article reads:

"If any shall be heard to swear, curse, or blaspheme the name of God, the commander is strictly enjoined to punish them for every offense by causing them to wear a wooden collar, or some shameful badge, for so long time as he shall judge proper. If he be a commissioned officer, he shall forfeit one shilling for each offense, and a warrant or inferior officer sixpence. He who is guilty of drunkenness, if a seaman, shall be put in irons until he is sober, but if an officer, he shall forfeit two days' pay."

Under the present articles, these offenses, along with "any other scandalous conduct tending to the destruction of good morals," are made subject to "such punishment as a court-martial may adjudge." The present system is more humane; but that of 1775 was quite in harmony with the times, when the whipping-post and the public stocks were familiar sights, and when people found joy in heaping contumely on petty offenders against law and good morals.

The fourth article provides: "No commander shall inflict any punishment upon a seaman beyond twelve lashes upon his bare back with a cat of nine tails; if the fault shall deserve a greater punishment, he is to apply to the commander in chief of the navy in order to the trying of him by a court-martial and in the mean time he may put him under confinement." One would suppose that twelve lashes on the bare back—"well laid on," as the ancient phrase ran—of a scourge consisting of nine lashes of knotted cord, would be punishment sufficient for any act of misconduct that could properly be spoken of as a "fault," to satisfy even the most severe martinet's sense of justice. But in the British Navy thirty and more lashes were not uncommon. Even three or four hundred lashes were on occasion adjudged, though probably no man survived to receive that number; and the victims of cruel flogging sometimes were left mangled and crippled for the rest of their miserable lives. Flogging was continued in the American Navy until 1862, when it disappeared along with rum.

The more serious offenses were to be dealt with by a court-martial. Those distinctly specified were, embezzling or stealing any of the ship's equipment or supplies, faint-heartedness in action, desertion of duty or station "while the enemy is in sight or in time of action," inciting or engaging in mutiny, uttering seditious words, striking an officer, quarreling or fighting, sleeping on watch or other neglect of duty, murder, robbery, and theft. Only for murder was the penalty of death mandatory. It might be adjudged in cases of desertion in action or mutiny, but was never to be executed until confirmed by the commander-in-chief of the fleet.

Under the present articles a court-martial is authorized to adjudge the punishment of death for twenty-two different offenses, though the death penalty is in no case mandatory. But the articles of 1775 had a general clause to cover all offenses that were not particularly specified. This clause declares: "All other faults, disorders, and misdemeanours which shall be committed on board any ship belonging to the thirteen United Colonies, and which are not herein mentioned, shall be punished according to the laws and customs in such cases at sea." Here was a grant of sweeping authority to maintain discipline and good order and to execute justice by appealing to the mandates

of what might be called the ancient common law of the sea. Doubtless under this ancient law some of the unnamed offenses were punishable by death. But the rights of the individual were safeguarded by the article which declared: "If any person shall apprehend he has just cause of complaint, he shall quietly and decently make the same known to his superior officer, or to the captain, as the case may require, who shall take care that justice be done."

Everything just set forth is found, if not in the same form, in substance in the present articles, except the recognition of the binding force of the ancient "laws and customs of the sea." Instead of this there is a vastly enlarged list of possible offenses—about all that one could think of as ever likely to be committed—and then, to provide against possible contingencies, we have Article 22: "All offenses committed by persons belonging to the Navy which are not specified in the foregoing articles shall be punished as a court-martial may direct." But "no sentence of a court-martial, extending to the loss of life [just as of old], or to the dismissal of a commissioned or warrant officer, shall be carried into execution until confirmed by the President,"—who is the commander-in-chief of the navy.

Many of the present articles, like the one just quoted, are, as I have already said, in almost exactly the same language as the corresponding articles of 1775. Further illustrations will make this clear. An article of 1775 reads: "Any master-at-arms who shall refuse to receive such prisoner or prisoners as shall be committed to his charge, or having received them, shall suffer him or them to escape, or dismiss them without orders for so doing, shall suffer in his or their stead, as a court-martial shall order and direct." A paragraph of the present Article 8 makes subject to "such punishment as a court-martial may adjudge" any person who, "when rated or acting as a master-at-arms, refuses to receive such prisoners as may be committed to his charge, or, having received them, suffers them to escape, or dismisses them without orders from the proper authority." The latter is more precise and grammatical than the former, but is clearly the same article worked over. The same is true of Article 25 which reads: "No man who may command by accident, or in the absence of the commanding officer, except when such commanding officer is absent for a time by leave, shall inflict any other punish-

ment than confinement." This is hardly better expressed than the sixth article of 1775 from which it is taken, namely: "The officer who commands by accident of the captain's or commander's absence (unless he be absent for a time, by leave) shall not order any correction but confinement."

Note also how exactly the article of 1775 regarding the sick-bay is followed by the present article. The former reads: "A convenient place shall be set apart for sick or hurt men, to which they are to be removed with their hammocks and bedding, when the surgeon shall advise the same to be necessary, and some of the crew shall be appointed to attend and serve them, and to keep the place clean." The language of the latter is: "Every commanding officer shall cause a convenient place to be set apart for sick or disabled men, to which he shall have them removed, with their hammocks and bedding, when the surgeon so advises, and shall direct that some of the crew attend them and keep the place clean."

The most striking instance of practical identity is that in the case of the first article, which gives the keynote of the animating spirit of the naval service. The wording of 1775 was: "The commanders of all ships and vessels belonging to the thirteen United Colonies are strictly required to shew in themselves a good example of honor and virtue to their officers and men, and to be very vigilant in inspecting the behaviour of all such as are under them, and to discountenance and suppress all dissolute, immoral, and disorderly practices, and also such as are contrary to the rules of discipline and obedience, and to correct those who are guilty of the same, according to the usage of the sea."

This is so nobly expressed that it was not easy to make any improvement. It appears as the present first article with hardly more than absolutely necessary changes. Now it reads: "The commanders of all fleets, squadrons, naval stations, and vessels belonging to the Navy are required to show in themselves a good example of virtue, honor, patriotism, and subordination; to be vigilant in inspecting the conduct of all persons who are placed under their command; to guard against and suppress all dissolute and immoral practices, and to correct, according to the laws and regulations of the Navy, all persons who are guilty of them: and any such commander who offends against this article shall be punished as a court-martial may direct."

In place of the earlier "all ships and vessels belonging to the thirteen United Colonies," we now have "all fleets, squadrons, naval stations, and vessels belonging to the Navy." Commanders in 1775 were "strictly required to show in themselves a good example," etc. Now the "strictly" is omitted. The example in 1775 was to be of "honor and virtue," which are comprehensive terms; but now it is to be of "virtue, honor, patriotism, and subordination." "To their officers and men" is omitted, as superfluous, as is "very" before "vigilant." "Behaviour" is replaced with "conduct," a change in the fashion of speech merely; "to discountenance and suppress" yields to the better phrase, "to guard against and suppress." "Disorderly" is omitted, as is also "such [practices] as are contrary to the rules of discipline and obedience," it evidently being thought that "dissolute and immoral practices" is sufficiently comprehensive. Now, moreover, correction of persons guilty of these practices must be "according to the laws and regulations of the Navy," not as in 1775 "according to the usage of the sea." The present articles nowhere recognize the ancient "usage of the sea" as now of binding force. The present article ends with providing for a court-martial for any commander that offends against it; a provision that John Adams would have thought unneeded, as being a thing of necessary implication. But with all these changes in detail, I venture to say that the reading of the first article of 1775 makes exactly the same impression as that of the present first article.

It is noteworthy, also, that the second article in each case relates to religious services. In a sense one might call this the first article, regarding what is numbered first as really a preamble to all that follows, something like the preamble to the Constitution. The religious article of 1775 reflects the more assiduous practice of religious exercises which was characteristic of the times, in requiring commanders "to take care that divine service be performed twice a day on board, and a sermon preached on Sundays, unless bad weather or other extraordinary accidents prevent it." The present article only requires "divine service to be performed on Sunday, whenever the weather and other circumstances allow it." This position of prominence of the article relating to religion goes back to very ancient times; beyond the period when formal articles were first adopted for the

government of the British Navy. Always men of the Anglo-Saxon race have acknowledged the divine government of the world, and the duty of public worship; have known that "except the Lord build the house, they labor in vain that build it; except the Lord keep the city, the watchman waketh but in vain." It is in this spirit that in the present second article "it is earnestly recommended to all officers, seamen, and others in the naval service diligently to attend at every performance of the worship of Almighty God." And it was in this spirit that the famous Samuel Pepys, for half a lifetime a most faithful, intelligent, and efficient administrator of the British Navy, wrote, near the end of the seventeenth century, the concluding paragraphs of his "Memoirs touching the Royal Navy." He was convinced "that integrity and general (but unpracticed) knowledge are not alone sufficient to conduct and support a navy." Neither would "experience alone and integrity, unaccompanied with vigour of application, assiduity, affection, strictness of discipline, and method" suffice. What was needed was a "strenuous conjunction of all these" qualities. And yet even under such conditions the British Navy "even at its zenith, did and suffered sufficient to teach us that there is Something above both that and us that governs the world. To which (Incomprehensible) alone be glory."

LECTURE II

THE DEVELOPMENT OF THE BRITISH ARTICLES

The "Rules for the Regulation of the Navy of the United Colonies," which were adopted by the Continental Congress in November, 1775, became the basis of the articles formulated in 1798, when the establishment of a navy began to be undertaken by the new Government of the United States. They were, therefore, as I have already pointed out, the American source and origin from which, with innumerable modifications and additions, the present articles have been drawn or developed. Those rules, you will recall, were framed by the great patriot, John Adams, who took them, with such changes as he thought expedient, from the "Articles for the Government of the British Navy" which were at that period in force. This method of procedure on the part of Adams and the Continental Congress was the obvious and natural course to pursue. It simply re-

tained and made authoritative the traditions and laws of naval service with which the seafaring population of the Colonies had time out of mind been familiar.

The British articles on which Adams drew were those which had been adopted by Parliament in 1749. In the most important respects the Adams articles follow their British originals, not only in substance, but also in language and in sequence of topics. But these British articles of 1749 did not originate in that year. They had a long history of development behind them.

From the fact that Great Britain is an island there was doubtless never a period of time when Britons did not on occasion put forth to sea with warlike purpose. But to the very end of the Middle Ages there was no regularly constituted navy that had a continuous existence. In return for certain commercial privileges, the Cinque Ports along the Channel—Hastings, Romney, Hythe, Dover, and Sandwich, to which other nearby ports were later added—were under obligation to furnish the king on his demand with fifty-seven vessels for war use. These were to serve for fifteen days in any one year at their own expense. They could be retained in service at a moderate fixed rate of pay as long as they were needed. In addition to this, the king could draft or impress into his service any ships—even those of foreign nations—that happened to be in any port of the realm. It was, therefore, possible to get together pretty expeditiously a sort of naval militia when an emergency arose. The king himself usually had a few ships of his own. They were literally his own property, built and maintained out of his privy purse. In times of peace they were hired out for purposes of trade. A king at his death disposed of them by will, sometimes directing that they be sold in settling up his private estate. About the beginning of the thirteenth century we have the first definite sign of anything like naval administration when King John appointed a "Keeper of the King's Ships." It is not unlikely that some similar functionary had previously been designated to have charge of the king's ships. This keeper of King John is the remote ancestor or prototype of the present Lords of the Admiralty. This is the oldest known administrative officer of the navy. Known later as "Keeper and Governor of the King's Ships" and as "Clerk of the King's Ships," he exercised control until the middle of the sixteenth century. But during all this

time it is to be remembered that the king's ships were not really a national navy.

There is no indication, as Mr. M. Oppenheim points out in his "Administration of the Royal Navy," that the early kings had any conception of the value of a navy as a militant instrumentality like an army; or of the importance of its continuous maintenance and readiness for use. Society was based on a military organization which recognized no use for a navy except in a subordinate and dependent character. Fleets were improvised, as occasion demanded, to transport troops, to keep open communications, or to meet enemy fleets already at sea; but the real work of defense or conquest was the duty of the men at arms that they carried. There was no comprehension of the ceaseless pressure that a navy can exercise, and the disbanding of a fleet followed promptly on its return from a successful exploit.

Under such conditions, when the operations of a naval force were of a temporary and fitful character and wholly subordinate to the military service of the kingdom, when the ships employed were for the most part commercial vessels, only withdrawn from peaceful pursuits to serve the state in an emergency, there was no need for permanent naval administrative machinery, and no special laws were required for the government or control of the officers and men who sailed these temporary war ships. These officers and men, the same as when engaged in commerce, were governed by the general maritime law of the time and by the ancient customs and usage of the sea. A compilation or code of maritime law was made in the twelfth century by Eleanor of Guise, the mother of Richard Cœur de Lion. This was known as the "Laws of Oléron," taking its title from the name of a large island off the west coast of France which was an important shipping center of the time. This code was long held authoritative in defining and regulating the rights and duties of shipowners, masters, and seamen.

The very first rules made by an English king to apply specifically to discipline on naval ships were issued by Richard Cœur de Lion in 1190, when he was passing through France on his way to join his fleet at Marseilles in order to sail for the Holy Land. The most important rules number only six, and very likely, merely gave definite expression to customs already well

established. They are sufficiently curious and interesting, as reflecting the spirit of the time, to demand our attention. In effect, as given by Clowes in his "History of the Royal Navy," they were:

"Anyone that should kill another on board ship should be tied to the dead body and thrown into the sea.

"Anyone that should kill another on land should be tied to the dead body and buried with it in the earth.

"Anyone lawfully convicted of drawing a knife or other weapon with intent to strike another, or of striking another so as to draw blood, should lose his hand.

"Anyone striking another with the hand, no blood being shed, should be dipt thrice in the sea.

"Anyone uttering opprobrious or contumelious words to the insulting or cursing of another should, on each occasion, pay one ounce of silver to the injured person.

"Anyone lawfully convicted of theft should have his head shaved and boiling pitch poured upon it, and feathers or down should then be strewn upon it, for the distinguishing of the offender; and upon the first occasion he should be put on shore."

The barbarity of the most of the penalties herein prescribed was in entire keeping with contemporaneous methods of executing justice. The last of the six rescripts shows that the gentle practice of tarring and feathering, still resorted to on occasion by lawless White-caps and Night-riders in administering rough and ready punishment on persons that have offended the moral sense or political prejudices of a community, is of very ancient, not to say honorable, pedigree.

About the middle of the fourteenth century what is known as the "Black Book of the Admiralty" was compiled. It is written in Norman French which was still the language of the court and of legal proceedings. This book defines with great detail the duties of an admiral. He was to appoint his lieutenants and other officers; was to get his fleet together by impressing ships found at the various ports; and was to enlist crews to man the ships. In other words, the entire power of creating a navy was for the time being entrusted to him. It was made his duty to administer justice "according to the law and ancient custom of the sea"—that phrase which is constantly recurring through the centuries. It was ordered that no seaman was to be beaten or

ill-used. Offenders were to be brought by the captain or master to the admiral to be dealt with according to the law of the sea. Search was to be made in ports entered for thieves who stole ship's gear. A man convicted by a jury of twelve men of stealing an anchor or a boat worth 21*d* was to be hanged; one that stole a buoy rope fastened to an anchor was to be hanged, whatever the value. Stealing an oar or other petty thing subjected a man on conviction by a jury to forty days' confinement for the first offense, six months' for the second offense, and hanging for the third offense. If a man that began a quarrel injured his opponent he had with other amends to pay a fine of five pounds to the king or lose the hand which struck the blow, unless the king or the high admiral granted grace. The Black Book contained many other ordinances relating to the disposition of prizes, the duties of impressed ships, and other topics. These ordinances continued to be the general regulations governing naval service for several generations.

It was the sixteenth century that saw the beginning of the British Navy as a thoroughly established and continuous force. This was during the reigns of Henry VIII and his great daughter Elizabeth. Continuity of policy and efficient administration were made possible by Henry VIII's creation in 1546 of the Navy Board. This became a vigorous governmental instrumentality under Elizabeth, and the brilliant achievements of the navy in war and the distant voyages of bold navigators during her reign founded, as Mr. Oppenheim says, "the school of successful seamanship of which was born the confident daring and self-reliance still prescriptive in the royal and merchant services."

In all this time, however, no special code of law was adopted by the Government for regulating and controlling the service of the navy. Ships still sailed under the ancient law and customs of the sea. But evidently there did exist or there were formulated by individual commanders certain particular regulations for the maintenance of order on ship-board. Under Henry VIII it was ordered that these regulations should be "set in the mainmast in parchment to be read as occasion shall serve." In these regulations we have the ancient rules of Richard that a murderer should be tied to the corpse of his victim and thrown into the sea; and that a man that drew a weapon on the captain should

lose his right hand. And there was this fiendish penalty for a man guilty of sleeping for the fourth time on watch: He was to be tied to the bowsprit, furnished with a biscuit, a can of beer, and a knife. There he was to be left, having the choice of starvation or of cutting his bonds and dropping into the sea. A thief was simply to be ducked two fathoms under and then to be towed ashore at the stern of a boat and ignominiously dismissed.

It became the custom for admirals on assuming command or setting out on a particular enterprise to issue a series of regulations for the ships of their fleet. Just when this custom originated is not known. One of the earliest documents of this sort now in existence was promulgated in 1596 by the Earl of Essex and Lord Howard of Effingham, joint commanders of the Cadiz Expedition. No doubt it was modelled on former regulations by other admirals. It is styled "Instructions and Articles . . . . to be observed by every Captain and chief officer of the Navy," and, in order that these might be generally known, captains are "straitly charged and commanded to give order that, at Service time, they may be openly read twice every week." Such public reading was necessary in that epoch, even though the articles were posted on the mainmast, because few seamen then could read. It is continued to the present day in spite of the fact that nowadays practically everybody can read. These "articles" number twenty-nine. In them one may discover the germ at least of many of the present articles. The very first one orders religious services "twice every day, except urgent cause enforce the contrary," and forbids religious disputes. This foremost place given to commanding religious services has continued, as I have said before, down to the present time. Swearing, dicing, and the like disorders are to be forbidden, "wherein you shall avoid God's displeasure and win His favor." Stealing is to be severely punished: if great, to be reported to the commander-in-chief, to be punished by martial law. The captains are to take special care to preserve the food supply, to guard against the danger of fire, to preserve the powder from spoil and waste, and to see to it that the ship is "kept clean daily, and sometimes washed." Rules for sailing and signals, for the treatment of prizes, and for the care of the sick are provided. The watch was to "be set every night by eight of the clock, either by trumpet or

drum, and singing the Lord's Prayer, some of the Psalms of David, or clearing the glass." No person should dare strike any officer on pain of death; anyone striking any inferior person was to be punished according to the offense by death or otherwise. And "no report or talk should be raised in the Fleet wherein any officer or gentleman in the same may be touched in reputation," except on pain of severe punishment.

It is to be noted that in these "Instructions" the death penalty is prescribed for very few offenses, but they do not cover the whole ground, the general enforcement of discipline being regulated by the ancient law and customs of the sea. Under those, great severity and inhumanity were allowed, and seem, under Elizabeth and her successors, to have become more common and recognized characteristics of the ordinary discipline. Perhaps this was due to the downward progress of the sailors in self-respect and social estimation. At least, that is the opinion of Mr. Oppenheim. This historian writes of the barbarous punishments of this period in these words: "Prayer was said twice daily—before dinner, and after the psalm sung at setting the evening watch; and anyone absent was liable to twenty-four hours in irons. Swearing was punished by three knocks on the forehead with a boatswain's whistle, and smoking anywhere but on the upper deck, 'and that sparingly,' by the bilboes. [These were irons or stocks, more or less heavy, and pinching more or less closely according to the enormity of the offense or the caprice of the officer.] The thief was tied up to the capstan, 'and every man in the ship shall give him five lashes with a three-stringed whip on his bare back.' This is, I think, the first mention of any form of cat. The habitual thief was after flogging dragged ashore astern of a boat and ignominiously dismissed with the loss of his wages. The brawling and fighting offender was ducked three times from the yardarm, and similarly towed ashore, and discharged; while for striking an officer he was to be tried for his life by twelve men, but whether shipmates or civilians is not said. If a man slept on watch, three buckets of water were to be poured upon his head and into his sleeves; and anyone, except 'gentlemen or officers' playing cards or dice incurred four hours of manacles. It is suggestive to read that 'no man presume to strike in the ship but such officers as are authorized.'"

The method of ducking was not particularly gentle. A rope was tied under the arms, about the middle, and under the breech of the victim. He was hoisted to the end of the yardarm whence he was violently let fall into the sea. Then he was hauled up and the process repeated the requisite number of times. If his offense was considered especially heinous he was also drawn under the keel of the ship and while there a great gun was fired over his head to increase his terror. The dreadful bowsprit starve-or-drown penalty was still awarded to the man guilty of sleeping four times on watch.

Under James I flogging became so common that we are told "some sailors do believe in good earnest that they shall never have a fair wind until the poor boys be duly whipped every Monday morning." The barbarous punishments of ducking, keel-hauling, tongue scraping, and tying up with weights hung around the neck "till heart and back be ready to break" continued to be common. And, under the Commonwealth, for drunkenness, swearing and uncleanness, a carpenter's mate was ordered among other penalties to receive ten lashes at the side of *each* flagship. This was the first punishment of its kind. Later it developed into the devilish torture of flogging around the fleet, which was common in the reign of Charles II, and was not abandoned till comparatively recent times. One cannot read the details of this monstrous practice without disgust and horror, and most of all, amazement at the callous inhumanity of our ancestors.

Sometimes peculiarly disgusting and humiliating punishments were devised. For example, a chaplain, who was on his own admission no saint, writes June 24, 1675, in a matter of fact way and with no sign of being himself in the least indignant, as follows: "This day two seamen that had stolen a piece or two of beef were thus shamed: they had their hands tied behind them, and themselves tied to the mainmast, each of them a piece of raw beef tied about their necks in a cord and the beef bobbing before them like the knot of a cravat; and the rest of the seamen came one by one and rubbed them over the mouth with the raw beef; and in this posture they stood two hours." And on a later date he writes: "A seaman had twenty-nine lashes with a cat of nine tails and was then washed with salt water for stealing our carpenter's mate's wife's ring."

The proclaiming of rules and regulations for the government of their fleets by admirals on their assumption of authority continued to be the regular and accepted custom. Indeed, the custom prevailed until the early years of the eighteenth century when the importance of it had long ceased to exist. Such instructions or regulations became ineffective when the occasion which had brought them forth passed, or their author laid down his office. Admirals undoubtedly followed in the main the proclamations of their predecessors repeating their rules and regulations. That is the natural way with men of authority in all the affairs of life in succeeding to the responsible control of a great organization. Equally no doubt there were multitudinous changes in modes of expression reflecting the personal taste of the author and the new fashions of speech, as well as changes of emphasis to meet new conditions. And always there were bound to be modifications, as old abuses disappeared and new arose, besides constant additions made necessary by the development of the service and the coming to the surface of new needs and new ideas of discipline. So gradually there came into existence a great body of these admirals' codes or articles, very similar, to be sure, in their main features, but growing clearer and more precise with the lapse of time. In them were to be found the essential principles of naval discipline.

But it was not till Cromwell's time that Parliament passed a law for the general government of the navy. In March, 1649, it adopted rules for the government of the Earl of Warwick's fleet. Three years later these rules were somewhat recast and modified and made to apply to the whole navy. These, therefore, were the first British Articles of War, specifically to be characterized as such, though they contained nothing that had not, in substance, at least, already been enforced in the navy under the authority of commanding officers. But here was a code of law, formally adopted by Parliament, to be of universal and continuing authority. It had the sanction not of the commander-in-chief only, but of the nation. This code, therefore, is the remotest formal ancestor of our American articles. It is especially agreeable to us to know that it originated when that great republican, Oliver Cromwell, ruled the destinies of England and added to the glory of her naval power.

Not long after the Restoration—in 1661—these articles, with some few changes and additions, were reënacted. In 1749, just one hundred years after the adoption of Cromwell's first articles, Parliament adopted new articles. These were the articles on which John Adams drew. Nearly one hundred years passed again, when Parliament, in 1847, enacted the present articles. But "the groundwork of all subsequent modifications, which experience has shown to be necessary down to the present day," was laid by the first articles, those adopted in Cromwell's time. Even much of the phraseology of the earliest articles recurs in the British and American articles of to-day.

The Cromwell articles number thirty-nine. The first enjoins religious service—just as former "instructions" and all later enactments have done. The second forbids words or actions "in derogation of God's honour and corruption of good manners." Religion and good morals have thus always been put at the forefront of discipline in both the British and the American navies. Of Cromwell's thirty-nine articles, thirteen prescribe the death penalty for specified offenses, and twelve others make death an optional penalty. But while the code was so severe in its terms, it was enforced with mercy and discretion. Up to the time of the Restoration there is no known instance of the death penalty being carried out. Three men of the *Portland* convicted of mutiny in 1653—during wartime—were let off with the savage but comparatively mild penalty of standing one hour with their right hands nailed to the mainmast and with halters about their necks. Three of their fellow mutineers were allowed to go after receiving thirty lashes.

In general, it may be said that the Cromwell articles traverse much the same ground and in much the same way as the articles of 1747, and so, of course, as the first American articles—those compiled by John Adams. How persistent the very words of an article and the order of their use may be is shown by a comparison of Article 12 of the code of 1747 with paragraph 13 of Article 4 of the present American code. It was under this Article 12 that the unfortunate Admiral Byng, after he failed to 1756 in the relief of Minorca, was convicted by a court-martial and suffered death; unjustly as is now the universal judgment. Article 12 fixed the death penalty, and that alone, for "every person in the fleet," convicted by a court-martial, "who through

cowardice, negligence, or disaffection shall in time of action withdraw, or keep back, or not come into fight," etc.

The worst that Byng was guilty of was bad judgment; of deciding that his fleet was too weak to justify him in making further effort against the French fleet. Loyal and brave as he undoubtedly was, he was evidently the kind of man,

"Who either fears his fate too much,
Or his deserts are small
That dares not put it to the touch
To gain or lose it all."

Byng's execution caused a vast uproar of disapproval, and the article was soon after modified so as to allow a lesser penalty than death at the option of the court-martial. This is the case under our code. But note how closely the language of our article coincides with that of the British: "Any person in the naval service who in time of battle displays cowardice, negligence, or disaffection, or withdraws from or keeps out of danger to which he should expose himself."

Even after the articles were adopted, commanders of fleets kept on issuing codes of instructions and rules, covering details of service and discipline. Finally, effort was made to digest and codify these innumerable rules and to make a clear and comprehensive set of regulations conformable to accepted principles of naval usage. So in 1731 appeared the first issue of "The King's Regulations and Admiralty Instructions." This code has been revised from time to time to conform with modern ideas and conditions, but remains in substance much what it was when first issued. Naturally, this code has had its influence on the development of similar regulations for the American Navy.

It is not surprising, therefore, that the two greatest navies in the world are practically alike in their organization, in the principles that animate and control their efforts, and in their ideals of service. Until less than a century and a half ago they have a common history and ancestry, stretching back into the dimness of the middle ages. Their conceptions of service and discipline like the principles of freedom, have

"broadened slowly down
From precedent to precedent,"—

and from precisely the same precedents. Moreover, because Britons and Americans possess similar mental and moral char-

acteristics, they have constantly, though sometimes unconsciously, absorbed much from each other, and so the development of their navies has been in nearly all respects along parallel lines. As a consequence of this fact, an officer of either navy soon feels perfectly at home on a ship of the other. He would have little to learn before he would feel completely at ease in performing the duties of his rank under the other's flag. Ships of the two navies in recent months have worked together without friction or jealousy and with perfect understanding and rivalry of effort, no matter whether for the time being the admiral directing their courses owed allegiance to the White Ensign or to the Stars and Stripes.

The Articles of War do not present a theme calculated to excite eloquent speech. But this cursory survey of the long history of their development proves in a very striking manner, as it seems to me, that

> "We that are to-day
> Live of the life that long has passed away."

The rules of the greatest and most glorious game in the world are not a thing of yesterday or the day before. They were born of the travail and the trial of ages; they are the result of centuries of experience and experiment; heated at the forge of battle, hammered into shape on the anvil of practical knowledge; tested and approved by great heroes of the sea. Any man in the navy that has a heart to understand and appreciate the spiritual in life must breathe freer and walk with a firmer step when he recalls that he is obeying the same laws that Rodney and Nelson and Napier obeyed; that he is under the same discipline that Decatur, McDonough, and Perry, Dahlgren and Porter, Farragut and Dewey, and a host of other patriots have honored and made illustrious.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PRESENT VITAL NEED OF A NAVY PERSONNEL POLICY

By COMMANDER FORDE A. TODD, U. S. Navy

> " Now there may be 'too much Nelson' for the
> Times have changed since then,
> But as long as man is human, we shall
> Have to count on men;
> Though machines be ne'er so perfect, there
> May come a day perhaps—
> When you find out just how helpless is
> A heap of metal scraps."
>
> CAPTAIN R. A. HOPWOOD, R. N.

Should the reader have to do with navy personnel in conjunction with the demobilization plan there may be no need of his going further than through the above few lines. Still, each has his view and, to properly arrive at the whole, many sides have to be considered.

On August 29, 1916, our navy was small. Since then it has grown large, at least in men. Hundreds of thousands of men have flocked to the navy's call. Now we trust that the reason of that great demand is wholly past, and the Navy Department stands ready to make their going out as voluntary as their coming in. A most liberal view has been taken and one that shows that the department has faith in the future.

But the navy must have men to exist. What will be the policy for the navy to adopt to man its ships? The answer to this question must be soon made and upon that answer depends the future of the navy. If that answer meets the navy's obligations it needs must be a liberal policy—a new policy—which concerns this article.

During the history of the United States our navy has risen four times and fallen three times. Its present rise has been con-

sistent over a period of twenty years and at the present is in the zenith of that rise. During each rise and fall the material has followed the lead of the personnel. So will it be this time if the personnel does not at once lay the foundation for getting new blood into the navy during the demobilization from this war.

Men will have to be drawn into the navy for different reasons than have just caused its immense increase. The majority of men at present in the navy came in with a view of doing their bit to win the war. Now that the war is over they are naturally anxious to resume their studies or business in civil life. The men to run the navy in the future will come in from an entirely different motive and that motive will, to a large extent, have to be created if the navy is to get and to hold men. And to hold men is one of the most important, to use an anomaly, necessities; for a continuous service man is, on the average, worth two rookies.

As we look at recruiting in the past, it has depended largely upon the publicity the subject has received, and, in peace times, has not been greatly influenced by hard times nor by the seasons of the year. It is fairly well established from interviewing several thousands of men, that conditions existing in the navy, and even pay offered, have very little to do with a man's first enlistment, but it has all to do with his subsequent enlistments and his potential value as a recruiting agent even after he is out of the navy.

Our policy must be shaped for holding men and creating recruiting agents of all men. The way to hold one man may lose another. We must hold the home builder as well as the rover, the mechanic and specialist as well as the seaman.

The navy is largely made up, especially in the deck force, of what is known as the motive type of man. He loves motion, action, and change of scenery. This desire is what made him give up the school, the office, the farm, or the factory.

Another class, or rather the men with a different viewpoint, are the married men. Almost without exception men coming into the navy in peace times are single, but a large number of them afterwards marry. Their viewpoint then is apt to change. They then desire a home port—a place where at even irregular intervals of necessary overhaul to their ships they will have a chance to be with their families.

There are others who look upon the navy merely as a shop where advance and money will come to the industrious. This is especially so in the engineer's force and in the special trades. Military necessity and discipline are incomprehensible to them. Not that they are refractory themselves, but merely that they find their off-duty hours aboard most irksome. Their idea is work during working hours and then stop work and go home.

It is true that there are very many other classes, but the number in each class is very small and may be neglected in considering the whole. The two latter large classes enumerated above are evolved after the men come into the navy, but the first big class is inherent in them all and is never dormant no matter how much counteracted upon by other desires and conditions.

To shape a personnel policy to fulfill the above conditions would not be hard nor would it detract from the efficiency of the navy or add to the budget. We have a building program, a gunnery program, an engineering policy, and even an insurance policy, but we have no policy for attracting and holding enlisted men.

We remember, about nine years ago, of reading a department letter to prospective recruits that a policy of foreign cruises had been adopted and recruits were promised that they would have the education and pleasure of travel to offset the close confinement and artificial existence on shipboard. Since then, until the war, few in the navy have, barring Guantanamo Bay and the York River, which belong to us, seen any foreign land except the coast of Mexico.

We, in the navy, shouldered with the responsibility of making the navy efficient are very apt to lose the proper perspective and fail to appreciate the man's point of view. The officer at the Navy Department goes home when working hours are over and refreshes himself with other interests. The officers at sea on whose shoulders rests the responsibility are kept going and occupied all their waking moments, even with messages and "shop" throughout their meals and with scarcely a night passing without demands for their services. The enlisted man stands his watch or does his drill and cleans his station and then only thinks of his condition in general or sleeps. More thought should be given to the enlisted man's condition. The officers of the navy should arouse themselves to the vital needs of the thousands of men who are more necessary to make a navy than the ships themselves.

What civilian, owning a factory or large business, would expect his employees, after working all day to then go to bed in hammocks swung over their machines, and continue to do this day in and day out, sometimes for months, and still remain contented and interested in their work?

It has been stated above that a policy would be easy of shaping. So it would and, not only easy, but very beneficial. In laying out a program some of the well recognized facts should be kept in mind and not wholly smothered as has been done in the past. A few of the most patent ones are as follows:

(a) Nothing makes sailors of men like going to sea.

(b) Nothing keeps machinery in such good condition as habitual use.

(c) Ships seem especially designed to prevent freedom of movement and nothing makes men, especially the type of men in the navy, more apathetic in their duties than continually doing the same thing and staying in one place.

(d) The fleet should maneuver together as a whole and divisions should have opportunities of exercising as divisions.

(e) Ships should not be kept too long in one place, as it is demoralizing both to the crew and the place.

(f) When giving liberty, ships should not be gathered together but should be disposed in the smallest possible units. A fleet giving liberty and leave in one place demoralizes the place by congesting the restaurants, the transportation facilities, amusement places, the sleeping accommodations, etc., to the annoyance of the citizens. If possible, only such number of ships should be sent to a place as can be easily assimilated by that place. In other words, "the dog should wag the tail" in every instance, and not the "tail wag the dog." Balance is necessary in all things.

(g) The thirty days leave periods should be equalized over the year.

(h) When giving liberty, thought should be given to transportation facilities and the pocketbooks of the men.

(i) Finally, work should be distributed evenly over the year in kind and amount, again preserving balance.

(j) Ships should have a home yard in which the plans and conditions are personally known by the yard personnel and the facilities and conditions known by the ship's personnel.

Bearing the above well recognized facts in mind, also the weather conditions of the seasons, a rough schedule of employment is outlined for a year, having regard for the enlisted man's contentment:

January 7. Leave home yards and go to Guantanamo, having fleet exercises on the way.

January 15 to March 1. At Guantanamo preparing for target practices. One day a week devoted to division maneuvers at sea.

March 1 to March 20. Devoted to target practices and war problems.

March 20 to April 1. Disperse fleet in West Indian towns of historical interest—one ship to a town—for liberty; allowing a pair of ships to change place.

April 1. Go north to home yards to grant leave and liberty. Fleet maneuvers en route.

April 10 to May 15. Leave and liberty periods doing repairs and overhaul with ship's force and drilling men in divisional drills, especially infantry drills in the yard.

May 15 to June 15. Assemble in some base away from distractions and hold gunnery and torpedo practices.

June 15. Start on European cruise having fleet maneuvers en route and arriving July 15. When in European waters disperse ships to seaports, two at most to any seaport. Interchange ships in different ports.

September 1. Start for home and hold fall practices on southern drill grounds before giving liberty.

October 1. Go to home yard for leave, liberty, drill, and ship's force repairs.

December 1 to December 15. Fleet or divisional maneuvers.

December 15 to January 7. At home yards for leave and liberty.

No contention is made that the above schedule is the best one, but it is simply given to clearly express the idea in a few words.

The home yards are thought best from which to give leave and liberty, as the ships are automatically dispersed, the men know the local conditions, many of them have established friends and families there, and it affords excellent opportunities for shore drills.

Leave and liberty are frequently mentioned in the above schedule, but that is principally with what this article has to deal. No one thinks it amiss if a workman goes home after his work is done, so each man should have the opportunity of going home as often as possible after working hours. It must be remembered that a certain proportion have to stay aboard to stand the watches, so they cannot go daily. Work on shipboard has, to a large extent, to go on on Saturdays, Sundays, and holidays. As to leave, only a portion can go on leave at once, so it takes a considerable time for a ship's company to finish its leave schedule. Each man is at present allowed 30 days' leave a year, which all government employees get, but only a very small percentage of the men now ever have the opportunity to take what is allowed them.

As outlined above, it is only contemplated allowing repairs to be made by the ship's force during the above visits to the yard. Regular overhaul periods will be had at stated times or when necessary. When at anchor in an open roadstead it is impossible to disable engines and overhaul boilers as they may be necessary on short notice on account of weather, but time should be given for the necessary upkeep by the ship's force as opportunities offer. As a side issue from the subject, this would result in much economy in repairs.

If such a program, taking into consideration the enlisted personnel's welfare, is put into effect and that program made public it is earnestly believed that the navy will not want for men and that the right men will make it their life work and a better navy will result.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

FEED-WATER TEMPERATURES

By LIEUTENANT P. V. H. WEEMS, U. S. Navy

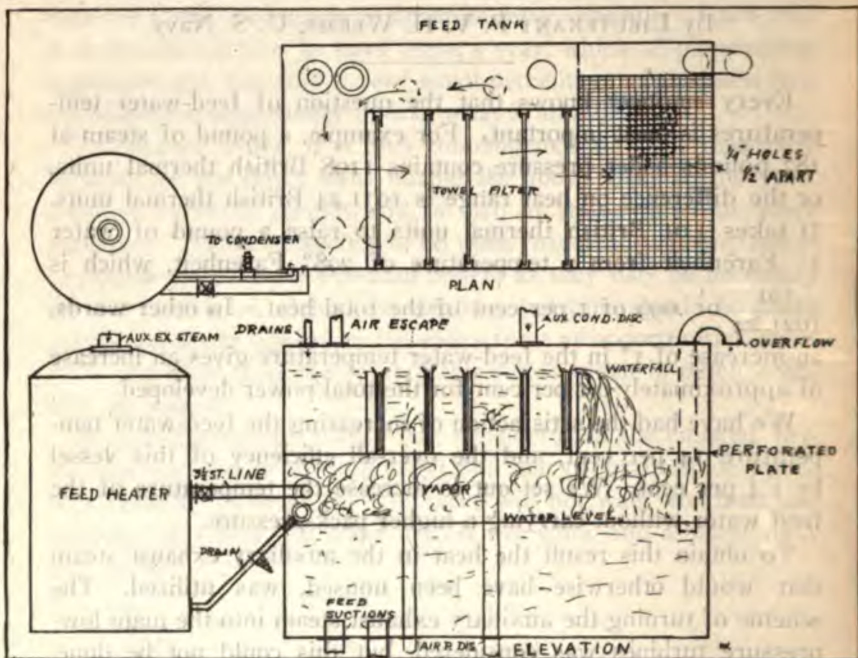
Every engineer knows that the question of feed-water temperatures is most important. For example, a pound of steam at 187 pounds boiler pressure contains 1198 British thermal units, or the difference on heat range is 1031.24 British thermal units. It takes 1.01 British thermal units to raise a pound of water 1° Farenheit from a temperature of 208° Farenheit, which is $\frac{.101}{1021.24}$ or .099 of 1 per cent of the total heat. In other words, an increase of 1° in the feed-water temperature gives an increase of approximately 0.1 per cent for the total power developed.

We have had the satisfaction of increasing the feed-water temperature 14 per cent, and the over-all efficiency of this vessel by 1.4 per cent. We set out to increase the temperature of the feed water without carrying a higher back-pressure.

To obtain this result the heat in the auxiliary exhaust steam that would otherwise have been unused, was utilized. The scheme of turning the auxiliary exhaust steam into the main low-pressure turbines was considered, but this could not be done. In other words, practically all the heat in the auxiliary exhaust steam is now lost except that used to heat the boiler feed water. In addition to this loss of heat units, the main condenser is given extra work by the amount of the auxiliary exhaust turned into it, with the resultant tendency to decrease, though very slightly, the main condenser vacuum.

In order to use more of the auxiliary exhaust steam, thereby saving the heat units in it, we improvised a jet condenser in the feed-water tank and ran a 3½-inch auxiliary exhaust steam line directly to it. This we did by drilling ¼-inch holes ½ inch apart

in a $\frac{1}{8}$-inch sheet iron plate and by bolting this securely under the feed-tank waterfall. The perforated plate has an area of about 20 square feet, over which the water spreads before spraying into the tank below. Then we ran a 3-inch steam line from the feed-water heater direct to the feed tank. This steam line was in addition to the $2\frac{1}{2}$-inch drain line from the bottom of the feed heater. In fact, the steam line was taken off at a point about half way up on the heater where the safety valve connection is fitted.



The effect was that steam at about 12 pounds pressure was led direct to the feed tank entering above the level of the water. It is so arranged that the steam must pass under the perforated baffle plate before it can escape. The cool water from the condensers pouring through the holes in the baffle plate makes an effective jet condenser and condenses all the steam that can be passed through the $3\frac{1}{2}$-inch line with the valves wide open. The original feed-tank drain, a $2\frac{1}{2}$-inch line, together with the evaporator drains, drains from all engine-room machinery, heating system, and galleys also run into the feed tank, bringing the feed-tank

temperature up to about 150° Farenheit. Without the direct steam line the feed-tank temperature is about 100°. The water from the feed tank is further heated when passed through the feed-water heater, from 150° Farenheit to 220° or 230°, depending on the back pressure.

From a careful average for a period of 7½ days, the feed-water temperature on a full speed run gave 205.7° Farenheit, with a pressure of 25 pounds absolute without the extra exhaust steam. Under practically the identical conditions with the steam line and the improvised condenser, the feed-water temperature was 223.7° Farenheit with a back-pressure of 26.9 pounds absolute. Allowing 4° for the difference in back-pressure of 1.9 pounds, the gain in feed temperature is 14° Farenheit. From the figures in the first paragraph this gives 14 times .001 or 1.4 per cent increase in efficiency, which in terms of fuel means a daily saving of 1.5 tons of fuel oil at 18 knots.

The idea of this improvement was gotten from Mr. Frazier, a Ward Line engineer, and the work was done by the ship's force.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME IDEAS ABOUT THE EFFECTS OF INCREASING THE SIZE OF BATTLESHIPS

By CAPTAIN E. J. KING, U. S. Navy

SYNOPSIS

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V. NUMEROUS BATTLESHIPS CONSIDERED TOGETHER. The Attributes of War. Co-ordination of Armed Forces. Involves Strategy, Tactics and Economics. Equal Strength and Equal Cost.

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I. FOREWORD

These ideas have been derived from many sources, probably none of them original, during a period of several years. They have been assembled in this form in an endeavor to bring them into orderly and related sequence for the readier consideration of just what advantages and disadvantages are involved when battleships are increased in size. Statement of obvious considerations is frequently made in order to express in full the connection of ideas.

A ship may be defined as a large self-propelled floating structure. A ship of given size displaces a volume of water equivalent in weight to the weight of the ship and its contents. On the displacement (size) of a ship depends its usefulness for the purpose for which it is built, whether naval or merchant, freight or passenger. Such usefulness is measured by the weight which can be carried in addition to the hull (or structure) weight.

Shipbuilding, in common with all other technical arts, is a matter of continuous progress; every ship must be an improvement of her predecessors of the same type; there is no finality and there can be none. The whole history of shipbuilding (naval and merchant) is one long series of steps in increase of displacement (size); there have been no permanent backward steps. The same fact holds true of all the mechanical arts; evolution and the developments in strength of materials and in application of power are continually bringing into play increased size to carry more power, or increased power to make the same size more effective; it is apparent that the combination of increased size carrying increased power must be the most effective of all.

With increased power or increased size, and certainly when the two are combined, comes increased cost, and in increased cost lies

the principal reason for opposition to the increased size (displacement), at least of battleships. It follows as an economic axiom that increased size (displacement) which involves increased cost can be considered justifiable only if there is adequate naval return for the increased cost. It should be noted, however, that increased cost is not necessarily due to increased size (displacement) alone, as will appear later.

II. THE QUALITIES OF NAVAL SHIPS GENERALLY

The term "useful displacement" is used by naval architects to represent the total carrying power of the hull structure which is available for embodying in the design the desired military qualities. The greater the total displacement the greater should be, in a well-designed ship, the relative "useful displacement," as such increase may be considered analogous to increasing the side of a cube, when the volume is increased to a markedly greater relative amount than is the area.

Certain essential qualities must be found to a greater or less extent in the design of all types of warships, be they battleships, battle cruisers, light cruisers, light cruisers (scouts), destroyers, submarines, and even in the cost of aeroplanes and dirigibles. Where any one or more qualities predominate, it follows that the other qualities must obviously be reduced in relative amount or even so far reduced as to become nominal.

The most essential qualities are:

Strength, both local and structural.

Stability and *buoyancy,* even when badly damaged.

Speed and *handiness,* for purposes of mobility.

Habitability, for the maintenance of personnel.

Economy of first cost and maintenance (upkeep); these two matters may sometimes appear to be opposed.

Length of vitality, which relates to the amount of fuel, ammunition, stores, etc., which affect the time that the ship can remain an efficient fighting machine.

Slowness of destruction, provided for by means of armor and by subdivision into compartments.

Armament, consisting of guns and torpedoes for the purposes of attack.

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To summarize, the ship (hull structure) must have the strength and stability, and buoyancy to furnish "useful displacement" sufficient to efficiently carry the weights needed for:

Armament.—Attacking power—guns, torpedoes.

Protection.—Resistance to destruction—armor, compartmentation.

Mobility.—Speed and handiness—motive power, turning qualities.

Endurance.—Longevity—fuel, ammunition, stores, etc.

Habitability is a relative term and is found in battleships to such a degree as to need no special comment.

First cost and upkeep are questions which will be taken up later.

The total displacement of a completed design is therefore to be considered made up of the following items; of these the maximum weights in the case of a battleship go to hull structure, protection, armament and machinery. The data concerning the most recent battleships are not available, but some idea of the relative apportionment of weights may be gained from the percentages cited, which obtain in the case of certain completed ships:

(1) Hull structure and fittings	35%	
(2) Armor and protection of hull structure	17%	25%
(3) Armor for protection of armament	8%	
(4) Armament and ammunition	18%	
(5) Machinery	12%	
(6) Fuel (on Acceptance Trial)	6%	
(7) General equipment and stores (Acceptance Trial)	4%	

It appears, therefore, that for a given displacement only a certain part of the total weight, or "useful displacement," is available to be used for the necessary fundamental qualities of a naval vessel, and that on the service for which the vessel is intended depends the general apportionment of weights to be used for the several qualities. If, in a battleship, it is desired to increase the armament, either the protection, the mobility, or the endurance (or two or all of them) must be reduced or the displacement (size) must be increased; obviously the same statement holds true in regard to the other qualities. It matters little whether the armament consists of many guns of large caliber or of fewer guns of greater caliber, it is the weight and distribution of weight necessary for the desired armament that matter. If there are many guns of large caliber there may well be more gun positions

to protect (which means more armor); if fewer guns, there may well be fewer gun positions to protect, but they will be of greater extent and probably more widely distributed.

III. THE QUALITIES OF SINGLE BATTLESHIPS

The primary qualities of a battleship are repeated, namely:

Armament.—Offensive or attacking power—guns, torpedoes.

Protection.—Resistance—armor and compartmentation.

Mobility.—Speed and handiness—motive power, turning qualities.

Endurance.—Longevity—radius of action, ammunition supply, stores, etc. These are sometimes considered included in armament and mobility.

Armament is the means provided for attack, *i. e.*, offensive action; ammunition supply is sometimes included.

Protection is the means provided to enable the ship to withstand the attack of other ships and should be thought of as resistive rather than defensive.

Mobility is chiefly concerned with the means for moving the ship as to speed; it includes turning qualities, which are inherent in the design of the ship as it is worked out. The fuel endurance, on which radius of action depends, is sometimes included under the heading of mobility.

Endurance relates to radius of action at various speeds, which depends primarily on the fuel supply; to amount of ammunition carried for a prolonged engagement at a high rate of fire; and to stores for the maintenance of armament, hull, machinery, equipment and personnel.

These qualities have now to be individually examined with a view to ascertaining what changes in them are effected by increase of size.

(a) *Armament.*—That the all-big-gun one-caliber battleship is the type that affords the greatest possible capacity of effective hitting may be considered established, especially in view of the present-day rapidity of fire of heavy guns and their greater accuracy at longer ranges.

Heavy turret guns such as make up the armaments of battleships cannot be mounted to advantage, *i. e.*, so as to increase the

effective hitting capacity, without considerably increasing the size (displacement) of the ship, because the number of gun-turrets that can be placed to best advantage is dependent upon the length or beam (or both) of the ship, both of which increase slowly with increase of displacement (size).

The battleship is essentially a gun-carrier. The only justifying reason in the minds of many for increase of displacement (size) is that such increase shall, primarily, be for the purpose of increasing fighting power, *i. e.,* armament. This appears to be sound doctrine, as armament is the special and the only positive element of fighting power; the other qualities may be reduced to insignificance, but the possession of armament indicates a vessel to be reckoned with. Protection and mobility are for the purpose of rendering the armament more effective, which fact indicates their subordination to armament.

Armament has reached such a stage of development that there are now three distinct means of increasing fighting power, namely:

(1) Increasing the number of guns.

(2) Increasing the size (caliber) of the guns.

(3) Increasing both size and number.

The first method increases fighting power by reason of the greater number of projectiles that can be fired, the second by reason of greater weight of projectile and the greater accuracy at great ranges, and the third obviously is a combination of the other two.

These three methods of increasing fighting power are embodied in three distinct variants of the dreadnought type, namely:

(1) Numerous guns in numerous turrets, which requires length of ship for advantageous arrangement, *e. g.,* the ex-Brazilian *Rio de Janeiro* with fourteen 12-inch guns in seven turrets; the U. S. S. *Wyoming* with twelve 12-inch guns in six turrets.

(2) Fewer but very heavy guns in double-gun turrets, which requires additional length and beam for the separation necessary to get the stability and the local strength to carry the concentrated weights, *e. g.,* the British *Queen Elizabeth* with eight 15-inch guns in four turrets; the most recent designs of U. S. battleships with ten (?) 16-inch (?) guns in five (?) turrets.

(3) Numerous heavy guns in fewer turrets, *i. e.*, triple- and quadruple-gun turrets, which requires structural provisions similar to those cited in the case (2) just above, *e. g.*, the French *Tourville* with sixteen 13.4-inch guns in four turrets; the U. S. S. *Pennsylvania* with twelve 14-inch guns in four turrets.

It is manifest that to carry these heavier batteries the battleship must be of greater size (displacement) no matter which one of the variants of type is built.

The larger ship is better from the point of view of operating the armament because it provides a steadier gun platform, being less affected by sea and swell. The command of guns, *i. e.*, their height above the water, can be greater, thus enabling them to be used more effectively in heavier weather and at greater ranges, the utility of which has lately been shown in the battle off Coronel and in our own winter operations.

Bearing in mind the saying of Admiral Farragut that "the best protection against the enemy's fire is a well-directed fire from your own ship," it would seem that if superior hitting power at greater ranges can be attained, so much the less is the need for devoting a large portion of the available weight to protection (armor). The logical development of this view would appear to result in the disappearance of armor as a part of the provisions for protection (resistance), and to this conception may be traced, at least in part, the genesis of the "battle cruiser."

It appears, from considerations of armament, that increase in size of a battleship provides for:

(a) More weight available to carry more and heavier armament (greater fighting power).

(b) Carrying more and heavier armament (greater fighting power) as result of increased size.

(c) More efficient employment of the armament, especially in heavy weather, due to higher command and to being a better gun platform.

(b) *Protection.*—It seems advisable to consider protection as a matter of defensive qualities only in so far as protection provides for the defensive by increasing the resistance of the ship to damage or destruction.

Protection divides into two main parts, armor and water-tight subdivision (compartmentation).

Armor, when viewed as a resistive quality of a battleship, calls for weight to be used

(1) For ensuring that the armament (and the armament personnel) shall be damaged or destroyed as little as possible.

(2) For ensuring that the stability and buoyancy of the hull structure are not materially lessened.

Increase in size should permit better comparative armor protection because there is more actual weight available, while its distribution is not over any comparatively greater area. Here again enters the question of

(1) Many guns in numerous turrets.

(2) Fewer but heavier guns in few turrets.

(3) Many guns in fewer turrets.

If the ship's fighting power (armament) is increased, any of the three types of armament call for more actual armor weight.

Increase of size should result in better under-water protection (compartmentation) because of greater relative subdivision, while not increasing actual size of compartments. Torpedo (and mine) effect, like projectile (and bomb) effect, is more or less local and can thus be confined to a smaller relative area, hence the necessary stability and buoyancy can be more readily safe-guarded in the larger ship.

The most up-to-date and effective methods of under-water protection, *e. g.*, multiple skins, armor bulkheads, cellular compartmentation, etc., not only call for more weight and more space (in order to work them in) but also cost enormously. However much they may cost they may be considered indispensable in these days of submarine and mining activities. Indeed, cellular compartmentation, in spite of its very great cost, may well become the only form of protection with which warships of the future are provided.

Increase in size does, however, produce a ship that offers a bigger target to both projectile (and bomb) and torpedo (and mine) as it will be longer, of greater beam, of possibly greater draft, and of probably greater freeboard with higher upper works.

As compared with weights devoted to mobility (speed) due consideration should be given to the permanence of service which effectively armed and protected ships can render in comparison with what often proves to be the short-lived value of faster ships

with less protection, *e. g.*, the present fighting usefulness of the *Oregon* compared with that of the *Saratoga*.

It appears, from considerations of protection, that increase in size of a battleship:

(a) Permits of more effective protection of armament, stability and buoyancy against projectiles (by means of armor).

(b) Permits of more effective protection of stability and buoyancy against torpedoes and mines (by means of compartmentation).

(c) Will provide a larger target to both projectile and torpedo.

(c) *Mobility.*—That part of mobility which is due to handiness, or turning qualities, is of secondary importance, but will be presumably less when the size of a ship is increased, chiefly on account of the greater length, which tends to increase the turning circle. Handiness is also affected by

(1) The shape of the under-water body.
(2) The size, shape and location of the rudder.
(3) The size, shape and location of the screws.

Handiness has a tactical usefulness only.

Of all the qualities which a battleship should have, none is more disputed than that part of mobility which speed supplies. Opinions range from those who advocate speed as a more or less direct means of offensive action to those whose idea is that high speed is an uncertain quality provided at great cost from every military point of view. Time is everything and speed directly affects time and so helps to overcome lack of foresight and errors of judgment. The true value of speed probably lies in the view that speed is not to be considered a weapon, but that, other things being equal, speed adds to the efficiency of the armament and confers a potential advantage on the side possessing it.

In two battleship fleets of the same gun power and armor the faster fleet would have an undoubted potential advantage, but assuming that these fleets are equally well designed, this superiority in speed, with equality in everything else, can only be attained by an increase in displacement with consequent increase in cost of building and of maintenance for individual ships.

However, advocates of high speed are numerous, and are inclined to the construction of ships in which high speed and heavy

armament absorb the weight now generally assigned to that part of protection which is provided for by means of armor. This is the "battle cruiser" type.

The opponents of high speed in battleships are somewhat insistent in their opposition. Their views may be summarized as belief that speed is an essentially precarious quality, too much so to absorb weight which could otherwise be given to other and more desirable and more permanent qualities. They point to the unreliability of speed due to foul bottoms, poor coal, green firemen, hot bearings, minor accidents to motive machinery, accidents to boilers or steam lines, damage to smoke-pipes in action, damage to hull by projectiles and torpedoes and mines, and in general to anything that may necessitate slowing down and may therefore prevent the availability and use of the high speed to which so much weight has been assigned, probably just when it is most needed.

Increase of size (displacement) of battleships only for the sake of providing more relative weight to be used to make higher speed is probably of doubtful wisdom, for to be logical increase of size should undoubtedly give marked increase in fighting power (armament).

However, in increasing size to mount heavier armaments if the same relative weights be available for speed-making purposes, it is usually the case that higher speed is attainable. The evolution and development of propelling machinery continues to enable faster ships to be built for the same relative weights. Increase of length consequent on increase of size (displacement) permits of the attainment of higher speed on less relative weight because speed (in knots) is, generally speaking, inversely proportional to the square root of the length (in feet), the ratio being expressed as $V \div \sqrt{L} = K$. Where K is greater than unity the speed is very high for any ship. Thus in increasing length to provide for heavier armament, it becomes possible to get higher speed without greater relative "weight cost."

The combined effect on speed of increased length, improved machinery and better design of underwater body is shown by the following comparisons. The ratio of designed horsepower to designed displacement in the case of the *Kansas* class (pre-dreadnought, 16,000 tons) was 1.03 for a designed speed of 18 knots; the same ratio in the case of the *Pennsylvania* (31,500 tons) is 1.00, but the designed speed is 21 knots. Again, the ratio

of designed horsepower to designed displacement in the case of the *Delaware* (20,000 tons) is 1.20 for a designed speed of 21 knots, whereas in the case of the *Pennsylvania,* with the same designed speed, the same ratio is only 1.00. Some idea of the relative " weight cost " of very high speed may be gained from the cases of recent "battle cruisers" where the above-mentioned ratio has values in the vicinity of 2.75 for a designed speed of 28 knots, and from the case of British battleships designed for 25 knots speed where the ratio is 2.10.

Increased size (displacement) confers an additional advantage in that it permits of higher sustained sea-speed due to the greater seaworthiness of the larger ship.

Therefore, it appears from considerations of mobility, that increase of size may be expected to result in

(a) Higher full speed on same relative weight.
(b) Higher sustained sea-speed.
(c) Less handiness.

(d) *Endurance.*—As has already been remarked, endurance may very well be included in armament and mobility, but it is deemed best to deal with it as a separate quality, as it directly affects the time that a ship can remain an effective fighting unit.

The ammunition supply that can be carried in the larger ship should be relatively more ample, thus enabling the heavier armament to fire more actual rounds, which makes her a more effective fighting unit, both at long ranges where the percentage of shots fired to hits made is small and at shore ranges where volume of fire is wanted. This has a distinct bearing on tactics.

The fuel supply that can be carried in the larger ship can also be relatively greater, resulting in greater fuel endurance which gives a greater steaming radius at all speeds. This has a great deal to do with strategical considerations, into which times and distances enter as matters of the first importance.

The stores carried in the larger ship can readily be provided in relatively greater quantity, which will increase what may be called the "cruising life," which is a strategical matter.

It would seem that, from considerations of endurance, increase of size can be expected to allow for

(a) Larger ammunition supply (battle).
(b) Greater steaming radius at all speeds (strategical).
(c) Stores for a greater "cruising life" (strategical).

(e) *Summary.*—The comparative advantages and disadvantages due to increase of size of a single battleship summarize as follows:

ADVANTAGES	DISADVANTAGES
As to *Armament:*	
Greater fighting power.	————
More efficient use.	————
As to *Protection:*	
More efficient against projectiles. More efficient against torpedoes.	Presents larger target to projectiles and torpedoes.
As to *Mobility:*	
Higher full speed on same relative weight.	Less handy.
Higher sustained sea-speed.	————
As to *Endurance:*	
Larger ammunition supply.	————
Greater radius of action.	————
Greater "cruising life."	————
As to *Cost.*	Costs more.

It seems, from the foregoing discussion and summary, that the sole disadvantage of major importance resulting from increase of size of a battleship, considered singly, is that it costs more; on the other hand, the larger ship is more powerful and has greater resisting qualities, is faster under all circumstances, and has a greater steaming radius and "cruising life." As the greater cost results in better naval "return for money invested," as regards the single ship, this seeming disadvantage is not one in reality.

IV. PROBABLE LIMITS OF SIZE OF BATTLESHIPS

Increase of size (displacement) must largely be gained by increase of length and of beam because any appreciable increase of draft is prohibited by the depth of water available (or likely to be available) in harbors and in channels leading to navy yards (dry docks).

It seems pertinent here to consider what the probable limits of size of ships may be. The apparent limits at present are

(a) The difficulties in securing the necessary structural strength, *i. e.,* a matter of material.

(b) The locks of the Panama Canal, which are 1000 feet long by 110 feet wide, and should take a ship 980 feet long and 110-foot beam.

(c) The depth of water leading to our principal dry docks, which may be assumed at about 35 feet.

If the structural difficulties can be overcome there would seem to be no reason why ships should not reach the limiting dimensions thus imposed.

A ship 980 feet long, with 100-foot beam and 33-foot draft and with a "block coefficient" of 0.60, would displace approximately 55,000 tons. It should be noted that the assumed ratio of length to beam is near 10: 1, which is better suited to a vessel of the so-called "battle cruiser" type than to vessels of the battleship type where the requirements of "useful displacement," stability and steadiness of gun-platform call for a ratio of length to beam of about 6 or 7 : 1. Such a ratio in the case of a battleship intended to pass through the Panama Canal would indicate a maximum length of 700 feet and a probable limiting displacement of about 45,000 tons.

V. NUMEROUS BATTLESHIPS CONSIDERED TOGETHER

War is a matter of defeat or destruction of the enemy's armed forces; hence it is a matter of fighting power, which quality in the case of battleships is supplied by the armament, which is provided with protection (resistance) in order that it may continue to be effective while receiving the enemy's fire.

War is also a matter of movement in order that the opposing forces may come into contact (battle) in order to obtain a decision; in ships this quality is included in the broadest meaning of the term mobility.

War is also a matter of supply, since the forces must have ammunition, food, clothing, etc., and, in the case of ships, fuel in order to retain the quality called mobility; the matter of supply affects the endurance of the forces, *i. e.,* the time that they remain of effective fighting value.

These attributes of war have already been dealt with from the standpoint of the single ship. War is further a matter of co-ordination of the available forces in order that the most effective use may be made of them; this co-ordination is employed in two principal ways, *i. e.,* strategy and tactics.

Strategy relates to movements and dispositions made before contact with enemy forces with a view to increasing the probabilities and the consequences of victory. Tactics relates to move-

ments and dispositions made after contact with enemy forces, "contact" meaning such proximity as renders battle imminent. Sooner or later strategical operations must result in battle.

Since numerous battleships are now being considered *together*, *i. e.*, in their collective relationship, and as the premise that a given number of battleships of increased size is superior to an equal number of battleships of smaller size (older) needs no demonstration, it becomes necessary to include further elements of consideration regarding numbers. Such premises are found in an examination of numbers with regard to:

(1) Equal collective (total) strength.

(2) Equal collective (total) cost.

Both of which are covered by consideration of "a less number of battleships of increased size (larger battleships) versus a greater number of smaller size."

(a) *Tactical Considerations.*—For other service than a fleet action diffusion of power may be needed, within certain limits of course, such limits being largely a matter of judgment (as differentiated from mathematical calculation); but, as participation in a fleet action is the function and "reason for existence" of a battleship, the question should be largely studied from that point of view. It is to be assumed that the primary function of a battleship is to fight her armament while under way in company with other battleships and while engaged in battle against opposing enemy battleships which are also under way, *i. e.*, tactics.

With increased size of battleships greater fighting power can be concentrated in a given length because more of it is embodied in individual units, which is highly advantageous from a tactical point of view if proper application of it be made. This advantage increases as the total fighting power involved increases, as it really is measured not only by what may be called "hitting power per mile," but is affected by the "number of miles opposed." The "distance" between larger ships may have to be actually greater in order to give the individual ships adequate sea-room in which to maneuver, but this only obtains in case of very marked difference in length (size).

A less number of larger as compared with a greater number of smaller battleships lends itself to better control of total fighting power because of the more centralized control, *i. e.*, the total

strength is contained in fewer units, which are manifestly easier to co-ordinate than a greater number of units.

The less number of larger battleships is preferable from a tactical point of view because of greater flexibility, *i. e.,* there are fewer individual units to be co-ordinated in their movements.

The greater number of smaller ships present more numerous targets and hence call for distribution of fire by individual ships composing the smaller number of larger ships; and, *vice versa,* the greater number of smaller ships must concentrate two (or more) ships on one target, whereby the rate of fire is slower, in order to obviate interference in fire control. Since the larger ships are more efficient fighting units and are better protected, and if the proportion of "smaller" to "larger" ships is not assumed as great as two to one, this situation is not necessarily to the disadvantage of the larger ships individually, as those larger ships which are concentrated on have superior protection as well as superior individual fire and, in the meantime, those larger ships which are not concentrated on, direct their superior fire on weaker ships.

The probably greater speed of the larger ships is tactically advantageous as it may well enable them to gain a superior position, *i. e.,* a position where their fire is more effective because the enemy cannot use his total fire.

The probably greater ammunition supply of the larger ships is a tactical asset because it enables them to maintain a given fire effect for a longer time.

The command of the guns in the larger ships should be higher, which is very advantageous in bad weather and for action at very great ranges. Also the larger ships should be better gun-platforms, especially in heavy weather.

The disadvantages, tactically speaking, are:

(a) Disablement of a "larger" ship is a greater actual and also a greater relative loss of fighting power than the disablement of a "smaller" ship. To offset this disadvantage there is the larger ship's less liability to damage because of her better protection, heavier armament and greater ammunition supply, higher speed.

(b) Handiness cannot be relatively as great, and, in order to permit of reasonable safety in maneuvering, "distance" may have to be made greater.

(c) The larger ships individually present bigger targets.

From tactical considerations, the advantages and disadvantages of increased size of battleships, considered together, summarize as follows:

ADVANTAGES	DISADVANTAGES
Greater concentration of fighting power.	———
Better control of fighting power.	———
Greater flexibility of movement.	———
Causes some opposing ships to concentrate.	Some ships must divide their fire.
Greater relative speed.	———
Greater ammunition supply.	———
Higher command of guns.	———
Better gun-platform.	———
———	Less handiness.
———	Bigger target.
Better relative protection.	Disablement of one ship is greater actual and greater relative loss.

(b) *Strategical Considerations.*—Some of the strategical considerations have already been indicated, but for the sake of clearness they will be mentioned again here.

Strategy is largely a matter of having a certain amount of fighting power at certain places at certain times. In so far as battleships are concerned, strategy chiefly demands massed power, which is represented by a number of battleships in company. Larger battleships are of greater value in a strategical sense because they permit the concentration of relatively greater power by the movement of relatively fewer units.

In regard to the diffusion of power sometimes mentioned in connection with strategical requirements, it should be noted that the aim is to be superior in force at the vital point and that this desired superiority of force can be obtained as well by means of fewer and more powerful individual units as from more numerous and less powerful individual units.

Times and distances enter so vitally into considerations of strategy that ships which have greater mobility and endurance are

of most value in this respect. The battleship of increased size is therein better suited to strategical purposes because

(1) Radius of action at all speeds is greater, due to greater relative fuel capacity.

(2) Sustained sea-speed in bad weather is greater because of greater seaworthiness.

(3) It has greater "cruising life" due to greater stores capacity.

From strategical considerations, it appears that the larger battleships possess all the advantages.

(c) *Economic Considerations.*—This is the real basis of controversy, *i. e.,* will "larger" or "smaller" ships make the better return on the amount invested? There are many who view with extreme reluctance the expenditure of large and increasing sums on single units of fighting power and bring forward statements in support of their contentions which are not only economic, but tactical; the tactical matters having already been dealt with, the economic considerations will now be taken up.

It has been shown that increased cost is not necessarily due to increased size (displacement), *i. e.,* it may be due to higher cost of construction of hull, of armor and especially of compartmentation, of armament, of motive machinery, of fittings and equipment, etc., whether such higher cost of construction be caused by increased labor cost (eight-hour law, better or more intricate workmanship, etc.) or by higher material cost. For instance, if the earlier (and smaller) battleships could have been built with equally good under-water protection, their first cost would have been much greater and the principal economic argument against the battleship of increased size would more obviously lose its seeming force.

It is a fact that the battleship of increased size considered as a single unit can be made to

(a) Have greater fighting power.

(b) Be more resistant by reason of better protection.

(c) Have greater mobility both as to high speed and as to radius of action, *i. e.,* it is a better fighting unit.

While the original first cost of the larger ship is greater and the cost of upkeep of the single ship may be greater, the matter of the operation and upkeep of the less number of larger ships

presents a different aspect, as in this respect they cost less because of

(a) Less total number of officers and men to man them.

(b) Less total fuel cost to operate them,

(c) Less total docking, repair and stores cost,

and it therefore appears that the total operating and upkeep cost of the less number of larger battleships must be less than the total similar costs in the case of the greater number of smaller battleships.

On the other hand, where the fewer larger ships are compared with the greater number of smaller ships, it is found that for the larger ships the damage or loss of a single ship is not only a greater unit loss in the military sense, but it is also a greater money loss; but, the larger ships are more effectively protected against damage.

From economic considerations, it appears that the advantages and disadvantages of battleships of increased size, considered together, are

ADVANTAGES	DISADVANTAGES
More powerful units.	Greater unit first cost.
Less operating and upkeep cost.	
Better protected units.	Greater unit loss risked.

Since the total first cost has been assumed to be the same whether larger or smaller battleships are built, it appears that the total operating and upkeep cost of the less number of larger battleships is less, which constitutes a decided economical advantage.

(d) *Legislative Considerations.*—An additional consideration which cannot be overlooked, although it may not be as it should be, is the fact that Congress does not use the budget system of making appropriations. "Increase of the navy" is voted by appropriating for certain numbers of vessels of certain types with fixed limit of unit cost, which is usually stated as "exclusive of armor and armament." As Congress is not likely to change its methods of making appropriations, our limited number of vessels should be as powerful as can be built.

(e) *Summary.*—The comparative advantages and disadvantages of numerous battleships of increased size when compared

with those of a greater number of smaller battleships, including the bases of equal strength and equal cost, summarize as follows:

ADVANTAGES	DISADVANTAGES
TACTICAL	
Greater concentration of fighting power.	————
Better control of fighting power.	————
Greater flexibility of movement.	————
Some opposing ships must concentrate.	Some ships must divide fire.
Greater relative speed.	————
Greater ammunition supply.	————
Higher command of guns.	————
Better gun-platform.	————
————	Less handiness.
————	Bigger target.
Better protection.	Disablement of one ship is greater actual and greater relative loss.
STRATEGICAL	
Greater fighting power in fewer units.	————
Greater steaming radius at all speeds.	————
Greater sea-speed in all weathers.	————
Greater cruising life.	————
ECONOMIC	
More power units.	Greater unit first cost.
Less operating and upkeep cost.	————
Better protected units.	Greater unit loss risked.
LEGISLATIVE	
Congress appropriates for ships in specific numbers and not by lump sum.	————

From the above discussion and summary it appears that a given number of battleships of increased size are of greater tactical and strategical value and of greater economic value than the greater number of "smaller" battleships that can be built for the same amount, or that represent the same total fighting strength.

VI. General Summary and Conclusions

In the course of the foregoing considerations and discussion, the following main points have been developed:

> The battleships of increased size, considered singly, can carry more fighting power, be protected for more effective resistance, have higher speed under all conditions, have greater radius of action and greater cruising life.
>
> That battleships of increased size, considered together, are of greater tactical value, of greater strategic value, and of greater economic value (because of less maintenance cost).

The conclusion that is to be had from the considerations set forth appears to be definitely in favor of the battleship of increased size.

DISCUSSION

The Naval Reserve After the War

(See Page 2757, Whole No. 190)

Lieut. Commander R. R. Smith, U. S. Navy.—There appears in the Naval Institute Proceedings for December, 1918, an article entitled, "A Plan for Maintaining the Naval Auxiliary Reserve after the War," by Lieutenant Ernest Draper, U. S. N. R. F.

The writer's plan for maintaining the Reserve leaves the impression that all officers of the Merchant Marine are to be under the control of the Navy Department under conditions similar to those which obtained during the war. Inasmuch as all of the merchant ships now being manned by officers of the Naval Reserve will revert to the owners or to the Shipping Board, it is difficult to see on what basis such a plan would be successful. In the first place the data furnished relative to the amount of shipping under the control of the Shipping Board, given as ten million tons, is misleading in that very little of this tonnage, at least less than one-half, can ever be permanently under the direct control of the Shipping Board. This ten million tons includes the Dutch ships which were taken over and which must be returned, German and Austrian interned ships whose status is not as yet settled, and all privately-owned vessels belonging to the railroad and shipping lines which must be returned to their owners.

Practically every officer in the navy who has given the matter any thought recognizes the need for a very strong Naval Reserve after the war. The Shipping Board is already undertaking considerable work in preparing civilians for seafaring life by establishing training ships and schools. The augmentation of the merchant marine personnel must, of necessity, be undertaken by the owners or controllers of the ships and not by the navy. It is hardly probable that the navy could run these ships on a commercial basis and it is not desirable that the navy should pervert its military activities and training to commercial channels.

To establish a Reserve we must approach the matter from an entirely different angle. I believe that the first requisite of an officer of the Naval Reserve is a good record in the merchant marine. It is entirely feasible to establish a correspondence course for these officers extending over a period of not less than one year; divide the work in such small portions that it will not become burdensome, and into at least twelve sections requiring some work during every month. I have discussed this idea with a number of merchant marine officers who stated that they would welcome such instruction as they could do the work at sea. There is no

opportunity for a merchant marine officer to study while in port, as his stay is very uncertain and usually is occupied with taking on or discharging cargo. This course should include strictly naval subjects, such as International Law, Gunnery, and Navy Regulations. The utter unfamiliarity of many of our Reserve officers with the Navy Regulations is deplorable. When first enrolled they must seek advice and guidance upon simple matters which they might determine for themselves with previous instructions in the regulations.

The correspondence course would, of course, be supplemented by examinations. The examinations would include subjects not included in the correspondence course which the officer might reasonably be expected to have studied, namely: seamanship, navigation and engineering. Upon satisfactorily meeting the requirements of the Department, the merchant marine officer can be enrolled in the Naval Reserve. After a reasonable specified period of service with a good record, promotion can be obtained in the Reserve by further study and examination in accordance with plans which should be made if such a scheme were instituted.

In connection with any correspondence course for officers of the merchant marine a library of standard Navy Department publications should be distributed, or sold. The details of the elaboration of this scheme readily suggest themselves. In order to lend some incentive to merchant marine officers to qualify for commissions in the Naval Reserve, retainer pay as members of the Naval Reserve will be necessary. The lack of complete success of the Naval Militia prior to the allowance of retainer pay was chiefly due to this cause. The writer was Inspector-Instructor of the Naval Militia of Oregon for a period of two years and found that the chief difficulty in securing attendance was the fact that no corresponding punishment, such as loss of pay, could be awarded for non-attendance; in the same manner with the incentive of retainer pay the Naval Reservist will keep up his studies and strive to obtain higher rank with increased retainer pay. Any scheme for augmenting the Naval Reserve which is not based on the individual's effort is bound to meet with failure. There is such a thing as a too paternal attitude which fosters lack of initiative. It will be impracticable for officers of the merchant marine to undertake naval cruises for their education, but it will be entirely practicable to place naval officers on board the larger merchant ships for a month or so for instruction purposes if the navy personnel ever reaches the point where there are sufficient officers to permit a thing of this nature being done.

I am a firm believer in intensive training and do not believe that a man has to do one thing all his lifetime in order to be reasonably proficient at it. Experience in training officers for engineering duty and hundreds of enlisted men for engineering ratings showed that men of intelligence and a reasonable amount of education are much more adaptable and can qualify for their work in a much shorter period of time than could reasonably have been believed possible before the war.

I do not regard it within the proper province of the Navy Department to initiate a supply of raw material for merchant marine officers other

than to lend encouragement to enlisted men of the navy to enter the merchant marine as officers. Agencies, such as the Shipping Board, should be more interested in training officers for the merchant marine. When these officers have been obtained, it will then become a matter of interest to the Navy Department to encourage them to qualify for commissions in the Naval Reserve.

The abolition of the Naval Militia eliminated the only non-professional element from the navy. Originally intended to organize the seafaring element of coastal cities, it succeeded only in organizing young men of no experience into units which received some measure of naval training. Their war experience has made them a valuable reserve. Their non-seagoing officers as well as the non-seagoing officers of the Reserve recruited chiefly from college men, who were intensively trained during the war and who will return to non-seagoing professions, will require different supervision with periodical cruises to keep them from losing the seagoing habit.

Unless a man has served in the navy during the war as officer or enlisted man, has retired or resigned from the navy, or regularly follows the sea as a profession, any effort to educate him for the Reserve will be fraught with the same difficulties which we experienced in attempting to develop a naval militia.

Notice Whole Nos. 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS (March, 1913, June, 1913, September, 1913, January-February, 1914, January-February, 1915, and November-December, 1916, January, 1918) are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 25 cents per copy.

ANNAPOLIS, MD., February 15, 1919.

INFORMATION INDEX

Underwood and Underwood.

"NEW MEXICO," UNCLE SAM'S LATEST DREADNOUGHT, AS SHE APPEARED FROM AN AEROPLANE DURING THE RECENT NAVAL REVIEW ON THE HUDSON RIVER.

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

BRAZIL

BRAZILIAN NAVAL VISIT.—The naval squadron which Brazil dispatched to European waters in order to coöperate with the Allied Fleet, and which was expected at Portsmouth to-day, having been invited by the British Government to pay a visit to this country, will not arrive until January 24, as the ships are calling at Lisbon. The squadron, although small in point of numbers, consists of several new and powerful vessels, all of which were built in British yards. The commander of the squadron is Admiral Frontin, an officer of progressive and up-to-date views.

It will be remembered that when Brazil entered the war in October, 1917, on the side of the Allies, her government, as the result of a conference between Admiral Caperton, commanding the American South Atlantic Fleet, and Admiral A. de Alençar, the Minister of Marine, undertook the responsibility of patrolling the South Atlantic. Early in January of last year the further announcement was made of Brazil's decision to coöperate with the Allied Fleets in European waters, and it was reported that the force allocated for this purpose consisted of a squadron of cruisers and destroyers.

The squadron under the command of Admiral Frontin is composed of two light cruisers, the *Bahia* and the *Rio Grande do Sul*, with four 27-knot destroyers. The first-named vessels were built by the Armstrong firm at Elswick, and were completed in 1910. They have a length of 380 feet, a beam of 39 feet, and a mean draft of 14.5 feet. The displacement is 3,100 tons. Protection is given by an armored deck of 1.5 inches thickness, with 5 inches of armor on the conning-tower. The armament comprises ten 4.7-inch (50 cal.) guns, two of which are mounted to fire ahead, two right astern, and five on each broadside. There are also six 3-pounders and two 18-inch torpedo tubes. The machinery, manufactured by Messrs. Vickers, is of the Parsons' turbine type, operating three screws, and sup-

plied with steam from ten Yarrow boilers. As designed, the engines were to develop 18,000 s. h. p., but this was exceeded on trial in both vessels, when the speed obtained was over 27 knots. The maximum quantity of coal which can be carried is 650 tons. The destroyers were built at the Yarrow yard, and displace 650 tons. Their dimensions are: Length, 240 feet; beam, 23.5 feet, and mean draft, 7.6 feet. The armament consists of two 4-inch guns, four 3-pounders, and two 18-inch torpedo-tubes. They have reciprocating engines, with Yarrow boilers, and, as designed, the engines were of 8000 i. h. p., to give a speed of 27 knots, which was considerably exceeded on trial.

From the United States the squadron came to Gibraltar where it arrived on November 10.—*London Times*, 15/1.

FRANCE

SIZE OF FRENCH NAVY.—At the time of Germany's request for an armistice, the French Navy consisted of 1,296 vessels of all classes, excluding transports and those ships which were either in reserve or in process of equipment or used for training purposes. Eight hundred and seventy-four units were armed for the war against submarines—namely, 735 vessels used for escort and patrol work and the protection of fisheries, and 130 submarine chasers, in addition to 192 mine-sweepers. Seventy vessels maintained the service of inspection of merchantmen at harbor entrances. The naval forces, made up of squadrons and large type vessels sent on special missions, numbered 117 battleships, cruisers, and large torpedo boats, which, since August, 1914, were almost continually away from France. Finally, 43 submarines took part in various naval operations. The French Navy also possessed 870 aeroplanes and 258 dirigible or captive balloons.—*United Service Gazette*, 9/1.

FRANCE'S WAR TONNAGE LOSSES.—According to a calculation by M. Paul de Rousiers, the French mercantile marine had a tonnage of 2,498,286 gross tons at the outbreak of the war. From the beginning till the close of hostilities, 1,037,773 gross tons of French shipping were lost. Of this total, 920,152 tons were destroyed through war's causes and 117,621 tons disappeared in consequence of ordinary sea perils. As during this same period, new vessels, aggregating 132,290 gross tons, were completed in French yards and ships representing 249,255 gross tons purchased from foreign owners, the French merchant marine totals at present of 1,842,058 gross tons.—*Nautical Gazette*, 1/2.

FRANCE'S MAN-POWER IN THE WAR.—The Ministry of War publishes statistics of the men mobilized for the army since the beginning of the war. Starting with the figures 92,838 officers and 3,781,000 other ranks on August 15, 1914, the strength of the army reached on January 1, 1918, the total of 128,372 officers and 5,064,000 other ranks. The new classes from 1914 to 1918 realized in all 1,098,000 men, the largest contingent being furnished by the 1915 class, which produced 265,000 men. Two combing-outs in September, 1914, and in February, 1917, produced 575,000 men.—*London Times*, 1/23.

FRENCH AIR SERVICE.—It is now permitted to give details of the progress of French aviation since 1914. When the war started there were 21 squadrons, with 321 pilots and a total *personnel* of 4,342. By the end of 1917 the *personnel* had increased to 75,105, the pilots numbering 6,417 and observers 1,682. The aviation programme of July, 1918, brought up the number of machines to more than 6,000.

The credits voted for the French Aviation Service in 1914 were just over two and a half millions sterling. This sum was quadrupled in 1916, and by 1917 had exceeded thirteen and a half millions.—*London Times*, 15/1.

GERMANY

GERMAN NAVAL CONSTRUCTION.—The utter collapse of German naval power had led to a heated discussion in the German press on the causes of the debacle. Capt. Persius attributes it mainly to the faulty construction and feeble armament of the capital ships and cruisers, but other officers demur, and the resulting debate has elicited some useful information. Writing as "a long-standing contributor to *Nauticus* and *Marine Rundschau*, and as first officer of a battle-cruiser, in which capacity during the war I superintended gunnery for two years and took part in the Skagerrak battle," Captain Schelbe points out that a ship's type is in its complexity one of the most difficult of technical compromises. According to this authority, the German constructors in adjusting weight pursued a middle course in relation to armament, armor, resistance, speed, and bulk. England subordinated protection, security, and resistance to offensive attributes, gun armament and speed. "The touchstone of a weapon is battle. Granted," he continues, "that the caliber of our guns was almost below what was requisite, and that the 4.1in. gun in the light cruisers did not fully comply with military requirements; still, after our successes in battle, it can by no means be maintained that our material was universally 'inferior' to the British and 'defective.' Admiral Lord Fisher was reproached, when the first dreadnought construction was announced, with these ships being ten-minute ships, that is, they would be overcome in ten minutes, for they did not possess the necessary resisting power. That more or less occurred. The cruisers *Indefatigable* and *Invincible* were blown to pieces some 15 minutes after fire was opened, and the cruiser *Queen Mary* after about half an hour. Our armament was in effect and accuracy superior to the British. The caliber of our guns proved sufficient. On the German side one capital ship, the *Lützow*, was put out of action, but it sank only during the return voyage. Ships with about 25 severe hits, and very dangerous damage below the waterline, got back to the home ports. The *Seydlitz* continued to fight to the end with undiminished speed, although struck by a torpedo in the forepart at the very beginning of the action." There is no reason to doubt the accuracy of Captain Schelbe's version of the damage sustained by the German ships, or of his claim that they possessed remarkable powers of resistance. This is the first admission that the *Seydlitz* was torpedoed early in the battle, and the fact that she did not fall out of line is undoubtedly a tribute to the excellence of her internal protection. On the other hand, the large number of "severe hits" admitted by this authority testifies to the accuracy of the British fire. Though their massive armor and minute subdivision kept the German ships afloat, the British shells took a heavy toll among the personnel—one battleship alone had 300 casualties after being under fire only a quarter of an hour.—*Engineer*, 10/1.

PRE-DREADNOUGHTS USELESS.—Captain Schelbe denies that the High Sea Fleet owed its escape to the timely intervention of thick weather. Most of the damage to both sides, he asserts, was inflicted in the first part of the action, when very good visibility prevailed. He agrees that pre-dreadnoughts cannot contend against ships of the all-big gun type, and proceeds: "The battle of the Falkland Islands cannot be adduced as proof that the German material was inferior, because in that case British ships of the dreadnought type were pitted against old German ships of the pre-dreadnought era. The absolute inferiority of the pre-dreadnought type in comparison with the modern battleship is an obvious fact, which was apparent in the Skagerrak battle, when the old British armored cruisers were destroyed. But Coronel is a proof that the oldest German material also was superior to the older British material. It is stated that, 'for a year it had been possible to speak of a German High Sea Fleet only in a restricted sense,' because a great many ships of the pre-dreadnought type

had been withdrawn from the first battle line in order to provide material for submarine construction. "In reality, the withdrawal from the first line was effected because the pre-dreadnought type is absolutely useless in a modern artillery battle. For this reason the British did not put their squadrons of older ships in their battle fleet, and for the same reason Admiral Scheer, after the experience of the Skagerrak, decided to withdraw them from the first line. That from the material of some older ships nickel had been obtained for submarine construction has nothing to do with this withdrawal."—*Engineer*, 10/1.

SUBMARINE TONNAGE FIGURES.—The battleship *Baden* is due at Scapa Flow this week, and with her arrival the surrender of the German surface warships, as stipulated in the armistice, will be complete, the battleship *Koenig* and the light cruiser *Dresden* having been delivered early in December.—*Engineer*, 10/1.

GERMAN NAVAL TYPES.—Of the five German battle-cruisers now in custody at Scapa Flow, the latest and most powerful are the *Derfflinger* and *Hindenburg*, which, if outward appearance goes for anything, are sister-ships. There is, however, some doubt on this point, though the report that the *Hindenburg* carries eight 15-inch guns, as against eight 12-inch in the *Derfflinger*, remains unconfirmed. The *Derfflinger* was laid down at the Blohm and Voss yard, in Hamburg, in March, 1912, and completed a week or two before the outbreak of war. Her dimensions and other particulars are as follows: length (on water-line), 689 feet; beam, 95 feet; mean draft, 27½ feet; normal displacement, 26,600 tons. The propelling machinery consists of "Marine" type—modified Parsons—turbines, driving four screws, and supplied by 18 Schulz-Thornycroft boilers, all of which are coal fired. The contract called for 63,000 horse-power and 26.5 knots, but those figures are nominal only. The maximum fuel supply amounts to no less than 4700 tons, including about 600 tons of oil. Like all German battle-cruisers, the *Derfflinger* carries a great weight of armor. The main belt, 12 inches thick, is surmounted by an upper strake of 8-inch armor, above which again is the 5.9-inch battery protected by 7-inch armor. The extremities of the ship are clothed with 4-inch or 5-inch plating as high as the main deck. At each end of the main belt there is a 10-inch transverse bulkhead, and two protective decks are fitted with an aggregate thickness of seven inches over boiler, machinery, and magazine spaces. The main battery comprises eight 12-inch 50 caliber guns, disposed on the center-line, all the guns having a wide arc of fire. Twelve 5.9-inch Q. F. are mounted in the upper deck battery, and there is a number of 3.4-inch Q. F., including several on A.-A. mountings, in the superstructure. The *Derfflinger* is heavily built up amidships, in contrast to the low freeboard at bow and stern. The large fore tripod carries a fire-control station, in the upper section of which a range-finder will be observed.—*Engineer*, 17/1.

THE GERMAN SUBMARINE "U. B.-64."—An opportunity having been given by the Admiralty for certain members of the public to inspect the German submarine *U. B.-64*, moored off the Terrace of the House of Commons, a description of the construction of this enemy submarine will doubtless prove of considerable interest to all of us.

To those who have tried to follow the trend of German submarine construction without inside information, the prefix "U. B." has always been taken to denote a small coastal submarine of a rather primitive type, as exemplified by the photographs which the French Government allowed to be published of the captured *U. B.-26* in dry dock. The dimensions of *U. B.-64*, therefore, came as something of a shock, for there seems to be little difference in size between her and the U-boats which we knew before the war.

Hull.—Like all modern submarines, she is constructed in the form of an inner cylindrical pressure-resisting hull on to which is built an outer hull of light plating. The water flows freely into the space between the inner and outer hulls, and therefore the plating of the outer hull is not subjected to any particular pressure. The inner pressure hull and the conning tower built on to it is the submarine proper, the outer hull being nothing but a light superstructure, built in the form of a ship designed to make her a passable sea boat when traveling on the surface, and to give a practicable deck. This ship hull has a very fair freeboard forward with a cutaway stem. The deck sheers considerably, has a flush midship section, and then drops until it is awash aft. It is of wood, the planks being spaced in order to offer no obstruction to the free flooding.

In order to neutralize our net barrages, a heavy saw-edged knife is fitted to the top of the stem, raking aft at an angle of about 45 degrees, and being supported by two steel struts. From this cutter two wires are led over fairlands on the conning tower and are secured to the deck aft, their object being to lift any obstruction or sweep clear of the vessel. A portion of their length before and abaft the conning tower is insulated to allow of their being used for wireless. The main wireless aerials are

GERMAN U-BOAT.

supported by two tall masts with quadrant heels, which are raised and lowered by means of wires from the interior of the boat. The after mast is fitted with rungs to enable it to be used as a lookout station. Normally they lie flat along the deck, which is recessed to take them.

On either side of the hull are the ballast and fuel tanks, the rounded tops of which make the "cigar-shaped hull" which shows in all the published photographs. As the fuel is used the tanks are allowed to fill with sea water in order to maintain the trim of the boat. It would appear that any or all of the ballast tanks can be filled with fuel oil to increase the radius of action, but, of course, the fuel would all be lost should it be necessary to empty the tanks hurriedly.

Conning Tower.—The conning tower, which is placed roughly amidships, seems very large for the hull, and is stream-line shaped with a sharp forward edge. It is surmounted by a permanent steel wind screen enclosing the "bridge," which does not, however, extend to the forward end of the conning tower, a steering position being exposed before it. The reason of this arrangement is not quite clear. The two periscopes pass through the conning tower and have a peculiar feature in that near the top they are suddenly thinned down, until their diameter is certainly not more than three inches. The value of certain published stories of a

few inches of periscope being sighted at 500 yards is demonstrated when the diameter is seen. One of these periscopes has the top of its casing cut away in such a manner that it is evidently designed for watching aircraft. Inside the conning tower is one of the control stations, from which the forward periscope is worked. The after-periscope is contained in a steel shaft. Scuttles are fitted in the sides of the tower and are embrasured in such a manner that the officers inside can command a view right ahead.

Just forward of the gun a piece of metal is hinged on to the deck, which, when opened, exhibits a large white ring. This is doubtless an identification mark for aircraft.

Gun.—A few feet before the conning tower a 3.4-inch (22-pounder) gun is fitted on a noticeably low pedestal. Judging from the elevation which its mounting permits it to be given, this gun should have a range which goes a long way to explain the frequency with which it was reported that the Huns contrived to outrange the guns carried by our merchantmen. Just abaft the gun there is a locker, under the deck, for a few rounds of ready ammunition, each round being contained in a watertight metal case similar to the one now being exhibited by the Imperial War Museum at the Grosvenor Galleries. In the case of a prolonged action, ammunition has to be handed out through the conning tower. Although frequently mentioned in reports of merchant ships attacked, there is no sign of a machine gun on *U. B.-64;* but on the conning tower there is more than one mounting that might have been designed for a machine gun or a searchlight—or both.

Boat.—Stowed bottom upwards on deck aft is a collapsible boat capable of accommodating about four or five men.

Compressed Air Service.—Outside the pressure hull, but visible through the open flanking of the deck, are secured several steel bottles for compressed air. These are used chiefly for emptying the ballast tanks should it be necessary to come to the surface in a hurry.

Interior of Hull.—Working from forward the arrangement of the interior of the hull is as follows: Right forward there is a large ballast tank, extending the whole breadth of the vessel, through which pass the four bow torpedo tubes. Close to them are placed four torpedo compensating tanks, the object of which is to maintain the trim of the boat whenever a torpedo is fired by immediately admitting an equal weight of water into the hull. It has frequently occurred that badly trained German crews have not flooded these tanks smartly enough when a torpedo was fired, with the result that the submarine has lost her trim as a result of being suddenly relieved of the weight right forward, broke surface with her bow and immediately became the target of the guns of the convoy attacked.

Forward Mess Deck.—The compartment next to the forward ballast tank, into which the breeches of the tubes project, is the forward mess deck, where some members of the crew are accommodated. Round the walls of the compartment are ranged folding iron-framed bunks, a luxury undreamed of in British craft of similar type. It would appear, however, that a portion of the crew have to sling hammocks. In addition to the torpedo normally carried in each tube, there is stowage for four spares in this compartment. When a vessel of this type puts to sea with a full crew the mess deck, at least, must certainly be uncomfortably crowded. Several steel flasks containing oxygen at high pressure are stowed here and right aft.

Officers' and Warrant Officers' Messes.—Immediately astern of this compartment, and divided from it by a bulkhead with watertight door, there is a small mess for the warrant officers, furnished with two bunks and a settee, but with little else in the direction of comfort. This, again, is divided by a sliding wooden door from the ward room, which is a much more showy compartment. Here the walls and bulkhead are covered

with stained panelling and wall cupboards, with glazed doors, are fitted for crockery and gear. A small folding table occupies the centre of the ward room, but can be quickly unshipped when desired. Three very sizeable folding bunks and a settee complete the fittings. Altogether, considering the size of the vessel, very much more comfortable quarters could reasonably be expected. The after wall of the wardroom is a bulkhead with watertight door leading to the

Control Room and Auxiliary Engine Room.—This compartment is divided into two by a light partition with sliding door in precisely the same manner as the ward room and warrant officers' mess noted above. It is the nerve centre of the boat and is nothing more than a crowded mass of intricate machinery. It is rendered more crowded still owing to the space occupied by a large steel shaft, inside which the after periscope and its operator are raised and lowered together by means of electric motors. The forward half of the compartment is the control room, the usual submerged action station of the captain; all controls are led here, as well as to the conning tower. On the port side the wireless room is enclosed in a silence cabinet, but in view of the close proximity of the auxiliary machinery it is very doubtful if the cabinet ever really deserves the adjective. Under the floor is the magazine for 22 pounder ammunition, chain falls being slung on to the deck beams above the hatch for the purpose of hoisting it out. The auxiliary machinery is closely packed into the after portion of the compartment, a lavatory being curtained off on the port side.

After Mess Deck.—Abaft the auxiliary machinery there is another mess deck, fitted with eight bunks and hooks for slinging hammocks in the same way as the forward one. In this compartment the head room is judged to be slightly under six feet, which may be taken as a fair average throughout the boat. There is a bulkhead with doors of the usual pattern at either end.

Engine Room.—In this type there is no division between the engine and motor rooms, the Diesel engines occupying the forward and the electric motors the after end of the longest compartment in the ship. The main engines are two 6-cylinder 4-cycle reversible Diesels, bearing the plate of the well-known M. A. N. firm. Judging from their appearance, they should develop about 500 b. h. p. each. The prize crew artificer in charge of the engine room was generous in his praise of the engines. Abaft the Diesel engines and on the same shafts are the two main motors for propelling the vessel under water. When the engines are being used on the surface the motors are either allowed to run free or else are employed as generators for charging the accumulators, which are stowed under the deck throughout the after part of the vessel. The cells are of the ordinary lead type, and do not appear to be any great improvement on our own. When running submerged the engines are disconnected by means of a friction clutch worked by hand. The switchboard is between the engines and motors and the control position is at the forward end of the motors.

Petty Officers' Mess.—Next to the engine room is a small compartment for the use of the petty officers, three bunks being fitted. In one corner of it is the galley, a very compact little electric stove, that must make the atmosphere unpleasant, in spite of the fact that the after hatch, which is too near the water to be opened in anything but fine weather, leads directly into the compartment.

After Compartment.—This compartment contains the after tube and its accompanying fittings, and the electric motors for working the vertical steering rudder and the two after horizontal hydroplanes. There is an emergency hand gear to both the vertical and horizontal rudders, and it is believed by the prize crew that it was the German custom to use these in order to reduce noise when they had reason to believe that we had listening gear in the vicinity.

The general impression gained by an inspection of *U. B.-64* is that the wonderful superiority of the German submarine designers over our own exists chiefly in the minds of certain members of the public. The totally different use to which their submarines were put caused them to pay very much more attention to the comfort of the men than in the British Navy, and in minor matters the German attention to detail and workmanship give them a distinct advantage. The machinery, periscopes, etc., are excellent and from all accounts they are splendid sea boats. But they are improvements on our own vessels of similar type only; they are not wonderful vessels that can do everything but fly. And under any circumstances, it must be remembered that *U. B.-64*, though right up to date, belongs to the smaller type.

Of the air-purifying apparatus of which so many wonderful and vague reports have appeared in the Continental press, there was no evidence, but in any case it would probably all be stowed away in a small box and might very easily escape notice.

The condition of the vessel when handed over was very bad and disgusted our men who took charge.—*Marine Engineer and Naval Architect*, January, 1919.

HOW IT HAPPENED.—On November 19, 1918, the well-known German military critic, Capt. Persius, published the following:

"The hope that the High Sea Fleet might in another Jutland battle be able to crush British naval supremacy, was merely based upon bluff and lies.

"In August, 1914, Germany had about a million tons of men-of-war as against England's 2.2 million tons.

"Thanks to Von Tirpitz's faulty constructional methods, German materials were inferior to the English. The German fleet was saved from a disastrous fate by Admiral Von Scheer's skilful orders and the clumsy manœuvering of Admiral Jellicoe, and the foggy weather which helped. If the weather had been clear and if both sides had had skilful commanders, the result would have meant our annihilation.

"The longer range English guns would have shot our weaker armed ships to pieces.

"*The losses of our fleet were enormous, despite fortune favoring us, and in June, 1916, every expert saw clearly that this battle would and must become the only one.*

"Tirpitz was attacked from all sides with the demand that only U-boats be built, but he remained silent. Finally, on October 1, the supreme army command was able to make their wishes felt by the members of the Reichstag—not by the Imperial Navy Department orders. Orders were given to cease building ships of the line and battle cruisers. U-boat material had now become so scarce that it had to be taken from the ships of the line in order to procure the requisite amount.

"*During the beginning of 1918, 23 ships had in this manner been taken from the High Sea Fleet—among these there was one which had been launched in 1916, 8 armed cruisers, 8 armed coast vessels, 16 small cruisers, and among these one which was launched in 1911.*

"This year, 1918, our High Sea Fleet consisted in battleships merely of dreadnoughts, ships of the line of the *Nassan, Helgoland, Kaiser* and *Markgraf* class, as well as some battle cruisers. Tirpitz putting all other vessels out of action was an admission that all other ships which he had built at the expenditure of millions between 1897 and 1906 were either useless or could not be used to fight British ships. Submarine warfare followed, for the weapons requisite for it practically did not exist. Capelle launched but a minimum quantity of U-boats. Had they been constructed, they would, as far as the larger U-boats are concerned, first have been ready for "action" in 1919 or 1920. In order to construct a large boat,

that is, one of 800 tons, took originally 24 months; one later, 30 months or more. The smaller boats of from 127-267 tons were at times completed in 13 months.

"During 1917, 83 were added and 66 lost.

"During 1917, Germany had 126 fighting U-boats, and in October 146, in February, 1918, 136, and in June, 1918, 113. It must be observed that of 'fighting' boats only a small percentage had actually been 'at the front.' In January, 1917, when conditions were more favorable, there were, for instance, 12 per cent at 'the front,' 30 per cent in harbor, 38 per cent were making trials, being repaired, etc., and 20 per cent were disarmed. During the years of war, the U-boats ran down badly. The crews had often all too short a time for training and had no longer confidence in their weapon. *It can thus be explained that there was of late but little desire for the dangerous service, and all the more so, as our world-experienced seamen saw and acknowledged how futile was all their sacrifice.*

"*The same was the case with the High Sea Fleet.* Its crew knew, when orders were given early in November to run out, that, with the small number of vessels, it meant the same as a useless sacrifice of countless precious lives.

"When there was question of battle, they demurred, and every sensible person will be grateful to them for this. By their action they rendered their people an inestimable service on the fifth of November."

WHAT WILL BECOME OF OUR NAVAL OFFICERS?—This is a question which is asked not only by naval officers themselves, but by many of our people.

Almost our entire fleet, and all of our submarines, are in the hands of our enemies, and our only hope is that, when peace is concluded, they may be so generous as to give back to us a part at least of our navy. Even if we should have the good fortune to recover the whole, the financial situation of our country would not be such as to permit the maintenance of as large a navy as we had before the war. The idea of demobilization entertained by our enemies in the first flush of victory, but which will not be feasible for some years to come, need not be taken into consideration. The fact with which we have to reckon is that it is more than probable that at least one-half of our naval officers will enter other professions. Among them are many elderly men, to whom the taking up of an entirely new calling is bound to be most difficult, but who, nevertheless, since they have families dependent upon them, will be obliged to seek a new source of income. Those to whom work is necessary must be distinguished from those who have adequate private means.

The next question to be considered is, for what form of employment the officers will be best fitted.

The three and a half years' instruction of the naval officer, and his later essentially practical experience, would make it seem that he is especially fitted for a practical calling. A nautical education produces a nautical "point of view" which may be called in general a "practical point of view." His knowledge of navigation is founded on an extensive knowledge of mathematics and natural science. In addition, the always increasingly complicated equipment and weapons of our warships, necessitate a fairly exact knowledge of various technical branches on the part of naval officers: for instance, fine mechanics and electro-technique. To these more special forms of knowledge is added the experience in organization, common to all officers, which often qualifies them to take the leadership in various branches of work. But especially valuable is the comprehensive grasp of affairs, which so many naval officers acquire from their voyages to foreign countries.

For what province, then, in the economic life of the nation is the naval officer best fitted? It is true, that the merchant fleets of the world lack efficient seamen, but not the German merchant fleet, the greater part of which we have already lost, the fate of the remainder being undecided until after the conclusion of peace. Moreover, the losses during the war, among merchant marine officers, were less than the losses in ships. Therefore, in this domain, also, loss of occupation is threatened, and, what would otherwise be so suitable a berth for the naval officer, is out of the question.

In a national air merchant service, which must come if we wish to profit by the immense progress made, during the war, in aviation, there would be great possibilities for employment. Here, the naval officer, with his knowledge of navigation, his nautical and technical knowledge, would be of the greatest use; the officers of the army flying corps would be also well fitted for the same calling. Such an organization. would offer great opportunities for employment, not only to naval officers, but to the active under officers of the navy as well. Finally, for elderly officers, who are unfitted for the more dangerous business of the service, there would be open a number of other branches. There would be positions for directors of different kinds of technical work to be filled, especially in the domain of wireless telegraphy, in which the majority of naval officers are particularly well grounded. For the younger officers, there would be an equal number of openings. Naval officers with a knowledge of languages could be employed with advantage in foreign countries, as commercial agents.

Finally, after this tremendous war, there will be many naval officers who will be in need of rest and quiet, and these should be given pecuniary assistance by the government, and allowed to form colonies on the crown or other government lands. Thus many a seaman would have his own bit of earth to care for.

At any rate, something must be done quickly. In order that everything may be in readiness, it is the duty of a grateful government to come forward with adequate remuneration for the courageous submarine crews and sailors of the entire fleet, who for four long years have cheerfully performed their dangerous and arduous service in our behalf.

The question remains, of how these ideas may best be made to materialize. It would seem most appropriate that the selection of positions should be a part of the duties of the secretary for demobilization, under whom should be a department for the promotion of the air merchant service, which would be managed to the best advantage by army and navy authorities in aviation. Besides the individual departments, there would be a central department having to do directly with applications for employment or for discharge from the navy. All this must be called into being quickly before it is too late. That is our duty to our naval heroes.—*The German Press.*

GERMANY'S NAVAL DEBACLE.—From the accounts which have appeared of the visit of the Allied Naval Commission to Germany, the state of demoralization into which the German fleet had fallen after the battle of Jutland becomes abundantly manifest. A member of the commission who has supplied an account of his visit to the *Times* quotes a German naval officer's views upon this subject. For what they may be worth the opinions of this officer indicate that even before the battle of Jutland was fought the Germans had given up hope of successfully fighting a battle with the Grand Fleet. In the newer ships methods of protection both against gunfire and underwater attack had been carried out so thoroughly and systematically as to make the ships almost uninhabitable. It was known, of course, even before the war, that the German officers of all the grades below a commander were provided with what in the British service would be considered insufficient cabin accommodation, but it is now evi-

dent that the crews of the ships for the great part lived ashore, and only spent a small portion of their time aboard the vessels.

The German officer assured one of the inspection parties that their ships were made "to fight, not to live in," and this is now proved to be literally the truth. It makes clear also why the German sailors protested against the conditions of living on board the interned ships at Scapa Flow. The internal construction and cramped conditions of habitability in the German ships is further proof, if proof were needed, that the Germans as a nation have not been capable of producing a seafaring community in sufficient numbers to fulfil the demands of their navy. The class of German seamen that manned the *Emden* and her sister ships and the vessels of Von Spee's squadron and the other craft which fought well in the Bight and in the earlier actions of the war, was exhausted by the disasters which fell upon the fleet at that period. After that the men, who lived in barracks at Wilhelmshaven and Kiel and only spent short spells on board the vessels, were neither real seamen nor had the makings of them. To these men the battle of Jutland was an eye-opener and exploded all the pretty tales they had been told by their officers about the invulnerability and invincibility of their ships. After that they could only be driven or inveigled into putting themselves within risk of an engagement with the British vessels. The *morale* of the German Navy had been broken, and it was only a question of time when the men would revolt.

The inspection of the German ports and shipbuilding yards by the Allied Naval Commission appears to have been most thorough and complete. The passage of the Kaiser Wilhelm Canal from Brunsbittel to Kiel by the *Hercules* and her attendant destroyers, the *Verdun* and *Viceroy*, was an historic event. Not only were the ships in harbor which are being dismantled and the building establishments visited as well as the extremely interesting experimental stations at Warnemunde, but also the air stations on the islands in the Bight and elsewhere. The Nordholz Zeppelin station was said to be beyond comparison the finest in the world, while the Nordeney seaplane station was reported as comparing most favorably with anything of the kind in France or England. It is not clear from the reports which have been published whether the investigators were given a sight of the instruments which the Germans used for gunnery control. All these instruments had been removed from the ships, but the British observers arrived at the conclusion that the German control of fire was as simple as it was efficient in the opening stages of action, and the fact that it deteriorated later on was probably due to human rather than mechanical failure. Once the control failed, the extreme nicety with which their guns had been calibrated was a disadvantage, for the projectiles from a broadside were so bunched together that very small errors in range or direction left the target untouched altogether. One other point in this connection it is well to note. The report states that "there is no reason to believe that they had anything better than the British for laying down the 'rate of change' and keeping the enemy under fire once he had been straddled."

With regard to the battle of Jutland, it is well to get a German point of view, but it is equally evident that the officer whose observations have been reported was not well informed on certain points. What he actually saw he could speak to, but otherwise his statements are largely speculative. He says, for example, that it was the knowledge in England that the German ships were putting to sea which brought the Grand Fleet out. This is not the case; the meeting was purely fortuitous. On the other hand, when he says that another hour of daylight would have finished the German fleet, he is indubitably correct. So also he is probably as near to the truth as possible when he says "our final escape was partly due to skilful handling, but more to the good luck which had been with us from the first. We passed the stern of the English fleet in the darkness." It is entirely credible also that the High Seas Fleet would never have allowed

itself to be drawn into action with Jellicoe's force if Admiral Scheer had known from aerial observation how near he was to the risk of a decisive action. Incidentally it was shown during the visit of the commission that a complete state of indiscipline and disorganization characterized what was left of the German Navy, both personnel and material.—*Army and Navy Gazette*, 18/1.

GERMAN NAVY'S DEGRADATION.—Everywhere the crews of German warships have relapsed into a state of complete indiscipline. Men drift away according to their individual inclination. The delegates of the Workmen's Councils have practically no control over the men, though the commissioned officers are compelled to salute them. All the ships in German ports have been allowed to get into a condition of unspeakable filth and disorder. Even the *Mackensen*, the latest German battle cruiser, which is not yet completed, is in a perfectly appalling state of filth, and is an offence to the nostrils even at a considerable distance.

The ships which were handed over and are now at Scapa Flow are much in the same condition. The *Baden*, the latest German battleship, has now arrived there. The crews of these German ships show a very decided disinclination to do any work whatever. Every order that is given to them has to be transmitted through the Workmen's Council, of which there are as many as three in large battleships. When the orders are transmitted in this way they are usually completely ignored by the men; though it has to be said that, in the case of the ships at Scapa Flow, the discipline there varies greatly as between different ships. There was a good deal of difficulty in getting these German ships up to Scapa Flow. They were very short in lubricating oil, and the disinclination of the engine-room to do a fair share of work was very marked. The result was that, though 12 knots was the set speed, the German ships were unable to keep it.

Allied naval commissioners have been supervising demobilization in German ports. They report an almost incredible amount of disorganization. Small mine-sweeping vessels, for instance, are apt to constitute themselves at any minute independent commands and to go off on errands of their own. There is now abundant evidence that the officers and responsible command of the German High Sea Fleet fully intended to come out to fight the Grand Fleet; but that the crews were quite resolved not to take the risk, and that the order to come out and engage the British fleet precipitated the revolution.—*London Times*.

ARMISTICE WITH GERMANY—SUMMARY OF ARRANGEMENTS FOR CARRYING OUT NAVAL TERMS.—*Introductory Note.*—In spite of the fact that this article will be two months old at the time of its publication, it is, nevertheless, believed that it may possess a historic value that will render it of interest to the service at large.

As a result of conference held on board His Majesty's ship, *Queen Elizabeth*, on 15th and 16th November, 1918, at which Rear Admiral Hugo Meurer attended as representative of the commander-in-chief, High Sea Fleet, it has been decided that arrangements should be made and action taken as stated below for the purpose of carrying into effect the articles quoted of the terms of armistice:

Article XX.—Admiral Meurer undertakes to communicate to the commander-in-chief, Grand Fleet, as soon as possible, full details as to the location of all ships of the German Navy, other than those included in the list already forwarded.

He undertakes to ensure that notification to neutrals as to freedom of navigation in all territorial waters, as required by Article XX, shall be made immediately on his return to Germany.

Article XXIII.—Admiral Meurer is informed as follows:

(a) It is necessary that the ships should first proceed to an anchorage in the Firth of Forth, but outside the precincts of the port. This is to

allow for examination and for embarkation of the British navigating parties who are required in order to ensure the vessels being safely passed through the British mine fields en route to port of internment.

(b) The rendezvous will be a position 40 miles 90° from May Island, the leading ship being in that position at 8:00 a. m. on Thursday, 21st November, 1918.

(c) German ships are to be formed up as follows:

(1) Heavy ships in single line ahead in close order three cables apart, with the battle cruisers leading.

(2) Light cruisers in single line ahead, three cables apart, the leading light cruiser three miles astern of the rear battleship.

(3) Destroyers to be in five groups three miles astern of the rear light cruiser.

(f) A sufficient force will meet the German ships and escort them to the anchorage, a plan of which has been given to Admiral Meurer.

Sufficient notice will be given by the commander-in-chief, Grand Fleet, to the German naval command of the date on which transports will be required to repatriate the crews and the place to which they should be sent.

Admiral Meurer states that *Konig* will not be ready to sail for three weeks, and that *Dresden* also is not ready. He is informed that *Konig* should sail in three weeks' time with *Dresden* in company. If *Dresden* is not ready to accompany *Konig*, *Konigsberg* is to take her place for internment.

It is noted that *Karlsruhe* will be interned instead of *Wiesbaden*.

Rear Admiral Meurer is requested to furnish a complete list of those surface warships of the German Navy, including river craft and auxiliary vessels, not specified for internment, and on which his information is at present incomplete.

Admiral Meurer is requested to arrange forthwith that *Baden* and three ships of the First Battle Squadron shall be based at Kiel, and the other four ships of the First Battle Squadron at Wilhelmshaven.

The light cruisers not required for internment shall remain where they are at present, pending further decision as to their disposal.

Should the German Naval Command desire to move a ship temporarily to facilitate demobilization, previous sanction must be obtained from the commander-in-chief of the Grand Fleet.

As regards these warships, Admiral Meurer states that German authorities desire to retain as many men on board as possible, after the ships have been disarmed, on account of the grave difficulty which exists in providing housing accommodation for large numbers of seamen at the German naval bases under present circumstances.

The commander-in-chief, Grand Fleet, will take up this question and communicate the decision of the Allies and United States to the German Naval Command.

Article XXV.—Admiral Meurer reports that sweeping up of mines in entrances to the Baltic is being commenced at once, and he undertakes to use every endeavor to ensure that the forts, fortifications, batteries and defence works shall be rendered ineffective at the earliest possible moment to the satisfaction of the Allied and United States Naval Commission.

Under these circumstances the Allies and the United States are prepared to refrain for the present from exercising the right granted by this article of occupying the forts, fortifications, batteries and defence works.

Articles XXVI and XXVII.—Admiral Meurer's written statement is satisfactory.

Article XXX.—Admiral Meurer undertakes to furnish the particulars required.

Article XXXII.—Admiral Meurer is requested to ensure that the notification required by this article is issued at the earliest possible moment.—26/11/1918.

GERMAN VERSION OF NAVAL SURRENDER.—We have received the following details from a reliable source concerning the meeting of the representatives of the German Navy with the English Admiral Beatty at Rosyth:

The English admiral had sent a personal message by wireless to the admiral of the German fleet, Von Hipper, to dispatch a flag officer of the German Navy to Rosyth in order to make further arrangements. The German admiral thereupon nominated Vice-Admiral Meurer for this purpose. Accompanying Vice-Admiral Meurer were Korvettenkapitan Hintzmann, Lieutenant zur See Braunck, and a deputation of the Soldier's Council of the High Seas Fleet and of the Republic of Oldenburg and Ostfriesland. The deputation left Wilhelmshaven on board the *Konigsberg* on November 13 at 3.00 p. m. The journey was made by way of Skagen, in order to avoid the mine fields in the North Sea. They arrived at Rosyth on November 15 at 7.00 p. m. The *Konigsberg* anchored in the outer roads. Immediately she anchored, an officer belonging to Admiral Beatty's staff arrived on board the *Konigsberg* with a letter from the English admiral, requesting Admiral Meurer with his staff to come on board the English flagship *Queen Elizabeth*, which was lying at anchor in the inner roads. The English destroyer *Oak* was ready to take them across. The names of the members of the German deputation had been made known to the English admiral by wireless. When Vice-Admiral Meurer inquired whether the three representatives of the Soldiers' Council of the High Seas Fleet were to accompany him, the English officer refused permission for them to do so in the name of Admiral Beatty. The three representatives were therefore obliged to remain on board the *Konigsberg*.

A meeting was at once held on board the English flagship under the presidency of Admiral Beatty. In addition to the latter, there were Admiral Madden, Admiral Tyrwhitt, the chief of staff of the English fleet, Vice-Admiral Brock, and a number of officers belonging to the English staff of the fleet. Admiral Beatty read out a list of the conditions of the armistice, and stated that he had been commissioned by the Entente and the United States to settle all naval questions relating to the armistice. When Vice-Admiral Meurer informed him that there were three representatives of the Soldiers' Council of the High Seas Fleet and of the Republic of Oldenburg and East Friesland on board the *Konigsberg*, Admiral Beatty refused to have anything to do with them, as he had not been authorized to receive representatives of a government which was not recognized by the English Government. At the second meeting on November 16, Vice-Admiral Meurer answered the questions put to him by Beatty, whereupon a discussion of individual points took place. In the final document, drawn up after the final sitting on November 16, evening, the arrangements for handing over the submarines and the ships and torpedo boats to be interned were laid down, as well as a number of questions to be settled by the German delegates on their return home. It is worthy of note that Admiral Beatty stated that he would forego for the present Article 24 in the armistice terms relating to the occupation of the Baltic fortresses, provided that Germany would immediately take steps to remove the mines from the Baltic.—*Berliner Tageblatt*, 20/11/1918.

GREAT BRITAIN

NEW BRITISH WARSHIPS.—*Repulse and Renown*.—The Renown was, together with *Repulse* and *Resistance*, authorized in the pre-war Navy Estimates for 1914-15, as an additional unit of the "Royal Sovereign" class of battleships. Subsequently, however, the plans of *Renown* and *Repulse* were modified to conform with battle-cruiser principles, the *Resistance* being dropped altogether. The *Renown* was laid down at Fairfield, and delivered ready for sea within a period of less than 18 months. Her sister ship was built at Clydebank with, we understand, equal rapidity. No official dimensions have as yet been made public, but

they are approximately as follows: Length, 794 feet; beam, 90 feet; draft, 30 feet; normal displacement, 26,500 tons. In weight they are, therefore, surpassed by several earlier vessels of the British Navy, including the *Queen Elizabeths* and the *Tiger*, but their great length makes them unique. Speed being the cardinal desideratum in this type, the lines of the hull are exceptionally fine, and weight is saved by reducing armor protection. To improve sea-going qualities, the bows, which are of "clipper" pattern, are flared to a remarkable degree. The scantlings are somewhat lighter than is customary, and special provision was found necessary to secure the longitudinal strength required in a ship of this great length, propelled by engines of extremely high power. The machinery consists of turbines, supplied by large-tube boilers, and designed for 112,000 horsepower, estimated to give a speed of 31.5 knots. This speed was easily exceeded, both on trials and afterwards in service, and there is, in fact, good evidence for the statement that *Renown* on more than one occasion has steamed for several hours at a mean of 34 knots. Details of the protective features of this type are not yet available. It is believed, however, that belt armor is either very thin or non-existent, reliance being chiefly placed on minute subdivision to localize damage by shell fire. But while the hull proper is probably innocent of vertical armor, due regard has been paid to the security of such vital positions as the barbettes and conning-tower, which are very heavily protected. Six 15-inch guns constitute the main armament; No. 1 barbette is situated on the forecastle, with the guns in No. 2 superfiring over it, while No. 3 barbette is placed on the quarterdeck. This arrangement permits of four guns firing directly ahead, and of a full concentration on either broadside; but the stern discharge is from two guns only. The auxiliary armament consists of eighteen 4-inch high-velocity quick-firers on triple mountings behind splinter-proof shields. The advantages of this method of mounting light guns were explained in a recent issue. There are also two 4-inch anti-aircraft guns and two submerged torpedo tubes. Since entering into commission *Renown* and *Repulse* have each been equipped with aeroplanes, launching platforms for which are fitted to the crowns of the barbettes. Reports as to the behavior of these two remarkable vessels while in service are somewhat conflicting. They are said to have developed structural weaknesses which necessitated the fitting of extra longitudinals; but, on the whole, they have proved very valuable additions to the Grand Fleet. The essential features of their design have, we understand, been further developed in the *Hood* and the *Rodney*, battle cruisers now being completed, which are 100 feet longer than the *Renown* class and carry eight 15-inch guns. It is reported also that the *Renown* has so favorably impressed *American* naval opinion that the United States battle-cruisers of the *Constitution* class have been re-designed on similar lines.

Furious, Courageous and Glorious.—Another remarkable group of ships built during the war consists of the *Furious, Courageous* and *Glorious*. It is generally understood that all three were built to a uniform design, but whether that be the case or not, drastic modifications have been made since. As originally planned she was a battle-cruiser of absolutely novel type, capable of running down the fastest enemy ships in any weather and dealing them stunning blows with her two 18-inch guns—the heaviest weapons ever mounted on board ship. For certain reasons, however, the armament was changed prior to her completion, and she left the builders' hands armed with a single 18-inch gun, the fore part of the deck being occupied by a large hangar, surmounted by a runway for launching seaplanes. Her equipment at this time included four Short aeroplanes and six Sopwith "pups." In August, 1917, experiments were conducted at Scapa Flow to ascertain whether it was feasible to land on the deck of *Furious* while the ship was in motion, in the course of which a very gallant officer, Flight Commander Dunning, met with a fatal accident.

Early in 1918 the *Furious* went into dockyard for conversion into a floating aerodrome in the literal sense of the term. The 18-inch gun was removed, and the whole of the deck abaft the single huge funnel was fitted up as a landing deck, the area being approximately 300 feet by 100 feet. Beneath the landing deck, which of course is a specially built structure, is a hangar, from which the machines are brought up to the deck by power hoists. The machines are handled by derricks and moved as required by trucks running on rails. The forward landing deck, which also has a hangar beneath it, is connected with the after platform by flying decks running each side of the funnel. Since these improvements were effected machines have no difficulty in landing on the deck of the *Furious* after returning from a flight. It need hardly be said that this wonderful achievement has enhanced to an incalculable degree the value of aeroplanes for naval service. The *Furious* is about 786 feet in length, 81 feet in beam, and normally draws 25 feet of water. Her displacement, as first completed, was 18,600 tons. Besides the main armament of two 18-inch guns, she was to mount twelve 6-inch quick-firing guns. She is fitted also with no fewer than 18 torpedo tubes, a feature that invites speculation as to the tactical ideas responsible for her design. Armor protection is confined to the barbettes and conning-tower, but the hull is protected by a special cofferdam from submarine explosion. The machinery consists of turbines of 90,000 horse-power for a speed of 31 knots, but the speed actually attained is much higher.

The *Courageous* and *Glorious,* built respectively by Messrs. Armstrong, Whitworth, and Harland and Wolff, are of the same dimensions as *Furious,* and the protective features are also similar. Their turbine machinery is of the same nominal power, viz., 90,000, and both ships are reported to have attained a speed of 33 knots. As a main armament they carry four 15-inch guns. The secondary battery consists of eighteen 4-inch quick-firing guns mounted in triples, as in the *Furious.* The ships are fitted with fourteen 21-inch torpedo tubes, all submerged. During the last year of the war *Courageous* and *Glorious* were attached to the Light Cruiser Squadrons of the Grand Fleet. Among other duties they carried out mine-laying, for which work they were fitted with rails along the quarter-deck and dropping gear at the stern.

Ramillies.—The *Ramillies* is one of the five battleships composing the *Royal Sovereign* class, which, in the opinion of many naval officers, is the most successful battleship type produced in this country during the dreadnought era. On a considerably smaller displacement, they embody all the admirable qualities of the *Queen Elizabeth,* except that their speed is only 21 knots. The principal dimensions are: Length, 624¼ feet; beam, 88½ feet; mean draft, 27 feet; normal displacement, 25,750 tons. The *Ramillies,* built and engined by Messrs. Beardmore, has Parsons turbines and Babcock and Wilcox generators, which are oil-fired. There are four propellers. The machinery is intended to develop 30,000 horse-power for a speed of 21 knots. The original design, which may have been modified, provided for a very comprehensive system of armor protection, including a belt of 13½ inches and barbettes of 14 inches thickness. It is probable that special provision was made subsequently for guarding the hull against submerged explosions. The armament comprises eight 15-inch guns in four barbettes, arranged in two groups at each end of the ship, sixteen 6-inch quick-firing guns in broadside battery, and four submerged torpedo tubes. The boiler uptakes are led into a single large funnel, the base of which has armor protection. The *Ramillies* and her four sister ships constitute one of the most powerful squadrons of the Grand Fleet.

Warspite.—The *Warspite* belongs to the *Queen Elizabeth* class of fast battleships. She was built at Devonport under the Estimates for 1912-13, the machinery being supplied by Hawthorn, Leslie and Co., Limited. Her principal characteristics are: Length, approximately, 650

feet; beam, 90½ feet; draft, 27½ feet; normal displacement, 27,500 tons. Machinery: Parsons turbines designed to give 56,000 shaft horse-power and a speed of 25 knots. The low-pressure turbines are on the inner shafts, the high-pressure turbines on the wing shafts, and the cruising turbines geared to the forward ends of the inner shafts, exhaust through the main high-pressure rotors to the condensers. There are 24 Yarrow boilers, all fired by oil, of which about 3500 tons can be carried. Although nothing official has been published, it is known that the *Warspite*, like the rest of her class, made very successful trials, realizing a speed considerably in excess of the contract figure. The belt armor is 13½ inches at the water-line, the barbettes are 14 inches and the battery armor 7 inches thick. The main armament is eight 15-inch guns, and there are twelve 6-inch quick-firing guns in an upper-deck battery. Four torpedo tubes are fitted.—*Engineer*, 1/24/19.

NEW BRITISH BATTLE CRUISERS.—The largest warship in the world is now being completed for the British Navy, and is expected to be commissioned in the first half of the year. She is H. M. S. *Hood*, a battle cruiser, the first of a group of four vessels which may be regarded as developments of the *Queen Elizabeth* type. The displacement is well over 30,000 tons, and the length no less than 894 feet, which is only 7 feet shorter than the *Aquitania*, the largest British liner afloat. H. M. S. *Tiger*, 698 feet, was the longest vessel in the navy of 1914, but she is far outclassed by the *Hood*, and even the American battle-cruisers of the *Constitution* type—872 feet in length—have lost their pride of place. A very high sea speed is aimed at in the *Hood* and her sister vessels. Although no official figure can be obtained, they are understood to be designed for 35 knots, which is likely to be exceeded in service. The machinery consists of geared turbines, supplied, we understand, with steam by Yarrow boilers burning oil only. Great attention has been paid to the protection of the hull against the effect of submerged explosions, which will be absorbed by a modified form of the "blister," or cofferdam system first applied to our large monitors. Notwithstanding her imposing size, the ship has most graceful lines. The "clipper" bows are heavily flared, and the forecastle deck is carried well aft. The main battery comprises eight 15-inch guns, mounted in two-gun turrets, all on the centre line, and there is an auxiliary armament of fourteen 6-inch or 5.5-inch guns in an upper-deck battery. The *Hood* has two funnels and two tripod masts, and in appearance is not unlike the *Renown*, except that she has an extra pair of guns astern. The *Anson*, a second battle-cruiser of the same class, is building, but it is uncertain whether the third and fourth ships have yet been laid down.—*Engineer*, 1/10/19.

A "COMPOSITE" DESTROYER.—One of the most singular examples of "reconstruction" in the history of the navy is furnished by H. M. S. *Zubian*, whose odd name requires some explanation. She is a composite vessel in the most literal sense of the term, having been constructed from the undamaged portions of two destroyers, viz., *Zulu* and *Nubian*. The first-named was attacked in the channel by German torpedo-boats on October 27, 1916, and torpedoed in the bows, sustaining damage so serious that she had to be beached. On November 8, in the same year, the *Zulu* was mined in the channel and docked at Calais. At a later date the two vessels were brought to Chatham Dockyard, where the hulls of both were cut in half, the forward section of *Zulu* being united to the after half of *Nubian*, the damaged bows of *Nubian* and wrecked stern of *Zulu* going to the scrap heap. The new boat, aptly named *Zubian*, has proved quite successful, and is known as a "composite" Hawthornycroft" boat, *Zulu* and *Nubian* having been built respectively by Hawthorn, Leslie and Co. and J. I. Thornycroft and Co. ten years ago.—*Engineer*, 1/10/19.

WARSHIP CONSTRUCTION.—Reports have appeared in several papers recently attributing to the Admiralty a decision to suspend the construction of certain of the vessels which had been put in hand during the war. It has been stated that of the four battleships or battle cruisers—for these vessels are rumored to have combined in their design certain of the qualities of both classes—which were building when hostilities were suspended, only one will be proceeded with. These vessels were to be named after distinguished admirals, and it is the *Hood* which, being more advanced towards completion than the others, will be finished and placed in commission, she having been launched from the yard of Messrs. John Brown and Co. at Clydebank.—*Army and Navy Gazette,* 18/1.

"THE MONITORS."—The name "monitor" is perhaps somewhat of a misnomer, inasmuch as the term has been associated in the past with small low freeboard ships, which followed the general idea of Ericsson's invention—the original Civil War "monitor" carrying a single turret in a hull which was almost awash. The U. S. *Terror* and *Osark* classes, our own

MONITOR "LORD CLIVE."

coast defenders, *Glatton, Cyclops* and the like, the Russian *Bronovesetz*, and the numerous Scandinavian types which abounded in the 'seventies, were true "monitors" embodying the low freeboard, and small target associated with the mounting of one or two heavy guns, and primarily designed for coast defence. And therein lies the radical difference between these more or less failures of small fighting value, which filled the navy lists of the past, and their present-day British "opposite numbers" which are essentially "coast offence" ships.

Their *raison d'être* was the German occupation of the Flanders coast, and main influencing factor the potentiality of the torpedo. Looking back on the ships employed in the early days during the German advance against the Channel Ports, one is struck by the motley collection of naval dregs which succeeded in retaining Dunkerque and Calais for us. Old battleships like the *Venerable* and *Redoubtable* (ex-*Revenge*), antiquated cruisers like the *Brilliant,* with a couple of 6-inch and six 4.7-inch guns, the gunboat *Rinaldo,* with four 4-inch; assorted destroyers, and so on down the scale to the obsolete gunboats *Bustard* and *Excellent,* which could barely make four knots and went astern from the recoil of their guns.

All these diverse craft did good service, but as the German guns increased in power and range and the additional factor of the submarine menace became of paramount importance in determining the types of ships which could be employed for the future, the necessity for something more efficient both in offensive and defensive qualities became imperative. And the "monitors" resulted.

To whom exactly the credit is due for their initial conception is uncertain. The writer has been assured that the genesis of the idea occurred to Lord Fisher while on a long train journey, and he, as the then first Sea Lord, certainly devoted an enormous amount of energy in getting the ships built as quickly as possible. It is said that the germ idea was simply a huge torpedo-proof hull, carrying a single turret, which could be towed in and out of action, the present ships being the logical developments from that basis. In any case, when the full facts are forthcoming it will be of more than passing interest to know to whom the inception and design of the monitors and their "blisters" is to be credited.

According to official nomenclature these coast-offence ships are "monitors," and the term is about as much descriptive of them as the tally "sloop" is of the *Flower* class of mine-sweeper. However, "monitors" they have been and always will be called, and may be the motherword has a wide enough general scope to include these huge overgrown progeny. Incidentally they are "large" monitors to differentiate them from the "small" monitors, Nos. 15-33, of a totally different type.

There are, or were, 18 of these ships altogether belonging to five more or less distinct types, differing in dimensions of gun-power, but as most of them have undergone some sort of a change in armament at one time or another, a classification of them as they were is preferable to one as they are. In all the design is essentially simple—a big, beamy, narrow draft hull, carrying a couple of heavy guns, well-protected, and a few smaller pieces, a heavy tripod mast with commodious control tops, light bridging and enough power for them to move from place to place against a moderate gale. The great feature of the ships are the "blisters" which are extensions built 15 feet or so beyond the hull proper on each side, composed of air and water chambers, subdivided into 50-odd compartments, and extending almost the full length of the ship, the idea being that the force of the explosion is expended on a buttress of water against a cushion of air, which is designed to localize the results. In practice the results have been excellent, some of the ships having been hit by one or more torpedoes without serious effect. Indeed, the story goes that one of the 12-inch monitors was hit by a torpedo aft, with the result that when the opposite compartments in the off-side blister had been flooded to obtain an even keel, there was a slight increase in speed due to the propellers having a greater submergence!

The main details of the first four types as they were completed are as follows:

	No. in Class	Dimensions	Tons	H. P.	Speed	Fuel	Guns	Compl.
(1) Abercrombie..........	4	320 ft. 90 ft. × 10½ ft.	6150	2000	6–7	400 Coal	2 14 in.	195–208
(2) Lord Clive............	8	325 ft. 87 ft. × 10½ ft.	5900	2310	6–7	400	2 12 in.	194–272
(3) Marshal Ney.........	2	355 ft. 8 in. 90 ft. × 10½ ft.	6670	1500	6–7	220 Oil	2 15 in.	173–187
(4) Erebus................	2	405 ft. 88 ft. × 11 ft.	8000	7240	14	650 Oil	2 15 in. 2 6 in.	226

The four "Abercrombies" originally bore the names of famous American generals (*Stonewall Jackson, Robert E. Lee,* etc.), but these were altered soon after they were completed. They are unique in being, with the *Canada,* the only ships armed with 14-inch guns in the navy, their weapons being the armament intended for the Greek battle cruiser, *Salamis,* building at the Vulcan Yard, Stettin. When war was declared the British Government took over the eight guns, turrets and mountings from the Bethlehem Steel Co., U. S. A., and apportioned them to these four ships, which did excellent work off Gallipoli. The *Raglan* was sunk off Imbros by the *Goeben's* salvoes last January.

Since commissioning, a 6-inch gun has been mounted in the centre line just abaft the funnel, and in common with all the ships, this latter has been raised so that the extension is now well above the navigating bridge.

The accompanying photographs show the general appearance of the ships, although hardly conveying the sense of squat, unwieldy bulk which

18-INCH GUN ABOARD "LORD CLIVE" AT FULL ELEVATION.

(Note deck magazines for 18-inch gun in centre of picture.)

is so characteristic. The hull side is practically straight and flat, with abrupt incurves at the bow and stern, the bow flare being pronounced. A curious effect is produced by the blisters when under weigh, the resistance being such as to cause a very broken water-line. Against a head wind they immediately drop their speed—the *Roberts* on one occasion having taken 25 hours to make 40 miles at full power in the Mediterranean,—and coming into harbor the wind and tide usually take charge and make navigation difficult. They roll and pitch slightly only in very heavy weather.

The *Lord Clive* group of eight ships are somewhat longer and have less beam, the draft being the same, and differ in having a pair of old 12-inch guns (mark viii, 35 caliber) taken out with turrets and mountings complete from the old *Mars, Magnificent, Hannibal* and *Illustrious.* Alterations were made to allow for an increased angle of elevation, and 24,000 yards' range was said to have been achieved by some of these old guns in consequence. All except the *Picton* and *Peterboro,* which went to the Mediterranean and Adriatic, were employed off Flanders. The *Picton*

has the honor of being the only ship which has been through the Suez Canal at full speed, *i. e.*, six knots.

A varying number of 6-inch guns has been added to their armament, usually four, while the *Lord Clive* and *General Wolfe* were fitted with a single 18-inch gun aft last summer and were just enabled to ease off a few rounds during the last phase of the Flanders evacuation before their sphere of usefulness came to an abrupt termination.

These guns were originally mounted in the *Furious*, and removed when she was converted into an aeroplane carrier. The projectile weighs 3,600 pounds, specially long tapering noses being fitted, and with 45 degrees elevation, the estimated range was 45,000 yards. Training is on the starboard side only, with a few degrees of lateral bearing, and at full elevation the breech is right down below deck level. The discharge had no effect on the ship's structure, and the blast was only experienced right at the end of the forecastle. Two searchlights will be observed just abaft the turret, and these were never damaged in any way.

The advent of the electrically-controlled boat-torpedo which would tend to ride up the blister, and explode against the ship's side proper led to the fitting of a strongly built guard-rail along the water edge which would either divert the boat hitting it at an angle or hold it up on direct impact.

SUBMARINES AND SPECIAL VESSELS.—Besides capital ships, cruisers, and destroyers, we have built during the last four years a great number of special types, including about 60 large and small monitors, 150 mine-sweeping sloops, and nearly a hundred submarines. The monitors and sloops call for no particular mention, their principal features being well known, but attention may be directed to the system of protecting the larger monitors from torpedo-attack by fitting them with an external cofferdam, or "blister." This somewhat crude device has proved very effective, but it has the disadvantage of making the ship unhandy and difficult to manœuvre. There are very few particulars available of the submarines built during the war, but it is known that a marked advance has been registered in the important qualities of speed, endurance, and habitability. In the big ocean-going submersibles of the "K" class we have resorted to steam as a prime mover, and although the advocates of internal-combustion engines condemned this as a retrograde step, the vessels are understood to have proved very successful. They are propelled by geared turbines, and, generally speaking, the machinery and boiler installation in the "K" class closely resembles that of the latest destroyers. It need hardly be said that an important increase in surface speed has been gained. When running on the surface with their two squat funnels up, these "K" boats may easily be mistaken for destroyers. While carrying out her trials in the Clyde in 1917 the *K-13* was accidentally scuttled, and many of those on board, including Commander F. H. H. Goodhart, R. N., and a number of inspection officials, lost their lives. The boat was afterwards raised and renumbered *K-22*. Submarines are now divided into several classes. Some were built specially for convoy duty, necessitating a large cruising endurance and good sea-keeping qualities, and others for mine-laying work. In addition to bow and stern torpedo tubes, the larger boats carry broadside tubes, an innovation that greatly increases their efficiency.—*Engineer*, 3/1.

VICTORIA CROSS—PUBLICATION OF "MYSTERY AWARDS."—*H. M. S. Q-5, February 17, 1917.*—On February 17, 1917, H. M. S. *Q-5*, under the command of Com. Campbell, D. S. O., R. N., was struck by a torpedo abreast of No. 3 hold. Action stations were sounded, and the "panic party" abandoned ship. The engineer officer reported that the engine-room was flooding, and was ordered to remain at his post as long as possible, which he and his staff, several of whom were severely wounded, most gallantly did. The submarine was observed on the starboard quarter, 200 yards distant, watching

the proceedings through his periscope. He ran past the ship on the starboard side so closely that the whole hull was visible beneath the surface, finally emerging about 300 yards on the port bow. The enemy came down the port side of the ship, and fire was withheld until all guns could bear at point-blank range. The first shot beheaded the captain of the submarine as he was climbing out of the conning tower, and the submarine finally sank with conning tower open and crew pouring out. One officer and one man were rescued on the surface and taken prisoner, after which the boats were recalled, and all hands proceeded to do their utmost to keep the ship afloat. A wireless signal for assistance had been sent out when (but not until) the fate of the submarine was assured, and a destroyer and sloop arrived a couple of hours later and took *Q-5* in tow. She was finally beached in safety the following evening.

The action may be regarded as the supreme test of naval discipline. The chief engineer and engine-room watch remained at their posts to keep the dynamo working until driven out by the water, then remaining concealed on top of the cylinders. The guns' crews had to remain concealed in their gun houses for nearly half an hour, while the ship slowly sank lower in the water.

(The award of the Victoria Cross to Com. Gordon Campbell, D. S. O., R. N., was announced in *London Gazette*, April 21, 1917.)

H. M. S. Prize, April 30, 1917.—H. M. S. *Prize*, a topsail schooner of 200 tons, under command of Lieut. William Edwards Saunders, R. N. R., sighted an enemy submarine on April 30, 1917. The enemy opened fire at three miles range and approached slowly astern. The "panic party" in charge of Skipper William Henry Brewer, R. N. R. (Trawler Section), immediately abandoned ship. Ship's head was put into the wind, and the guns' crew concealed themselves by lying face downwards on the deck. The enemy continued deliberately shelling the schooner, inflicting severe damage and wounding a number of men. For 20 minutes she continued to approach, firing as she came; but at length, apparently satisfied that no one remained on board, she drew out on the schooner's quarter 70 yards away. The white ensign was immediately hoisted, the screens dropped, and all guns opened fire. A shell struck the foremost gun of the submarine, blowing it to atoms and annihilating the crew. Another shot demolished the conning tower, and at the same time a Lewis gun raked the survivors off the submarine's deck. She sank four minutes after the commencement of the action in clouds of smoke, the glare of an internal fire being visible through the rents in her hull. The captain of the submarine, a warrant officer and one man were picked up and brought on board the *Prize*, which was then herself sinking fast. Captors and prisoners, however, succeeded in plugging the shot holes and keeping the water under with the pumps. The *Prize* then set sail for the land, 120 miles distant. They were finally picked up two days later by a motor launch and towed the remaining five miles into harbor.

(The award of the Victoria Cross to Act. Lieut. William Edward Saunders, R. N. R., was announced in *London Gazette*, June 22, 1917.)

H. M. S. Pargust, June, 7, 1917.—On June 7, 1917, while disguised as a British merchant vessel with a dummy gun mounted aft, H. M. S. *Pargust* was torpedoed at very close range. Her boiler-room, engine-room, and No. 5 hold were immediately flooded, and the starboard lifeboat was blown to pieces. The weather was misty at the time, fresh breeze and a choppy sea. The "panic party," under the command of Lieut. F. R. Hereford, D. S. C., R. N. R., abandoned ship, and as the last boat was shoving off, the periscope of the submarine was observed close before the port beam about 400 yards distant. The enemy then submerged, and periscope appeared again directly astern, passing to the starboard quarter, and then round to the port beam, when it turned again towards the ship, breaking surface about 50 yards away. The lifeboat, acting as a lure, commenced to pull round the stern; submarine followed closely, and Lieutenant Hereford, with com-

plete disregard of the danger incurred from fire of either ship or submarine (who had trained a Maxim on the lifeboat), continued to decoy her within 50 yards of the ship.

The *Pargust* then opened fire with all guns, and the submarine, with oil squirting from her side and the crew pouring out of the conning tower, steamed slowly across the bows with a heavy list. The enemy crew held up their hands in token of surrender, whereupon fire immediately ceased. The submarine then began to move away at a gradually increasing speed, apparently endeavoring to escape in the mist. Fire was reopened until she sank, one man clinging to the bow as she went down. The boats, after a severe pull to windward, succeeded in saving one officer and one man. American destroyers and a British sloop arrived shortly afterwards, and the *Pargust* was towed back to port. As on the previous occasions, officers and men displayed the utmost courage and confidence in their captain, and the action serves as an example of what perfect discipline, when coupled with such confidence, can achieve.

(The award of the Victoria Cross to Lieut. Ronald Neil Stuart, D. S. O., R. N. R., and Seaman William Williams, R. N. R., O. N., 6224 A., was announced in *London Gazette*, July 20, 1917.)

H. M. S. Dunraven, August 8, 1917.—On August 8, 1917, H. M. S. *Dunraven*, under the command of Capt. Gordon Campbell, V. C., D. S. O., R. N., sighted an enemy submarine on the horizon. In her rôle of armed British merchant ship, the *Dunraven* continued her zig-zag course, whereupon the submarine closed, remaining submerged to within 5000 yards, and then, rising to the surface, opened fire. The *Dunraven* returned the fire with her merchant ship gun, and at the same time reduced speed to enable the enemy to overtake her. Wireless signals were also sent out for the benefit of the submarine: "Help! come quickly, submarine chasing and shelling me." Finally, when the shells began falling close, the *Dunraven* stopped, and abandoned ship by the "panic party." The ship was then being heavily shelled and on fire aft.

In the meantime the submarine closed to 400 yards distant, partly obscured from view by the dense clouds of smoke issuing from the *Dunraven's* stern. Despite the knowledge that the after magazine must inevitably explode if he waited, and further, that a gun and gun's crew lay concealed over the magazine, Captain Campbell decided to reserve his fire until the submarine had passed clear of the smoke. A moment later, however, a heavy explosion occurred aft, blowing the gun and guns' crews into the air, and accidentally starting the fire-gongs at the remaining gun positions; screens were immediately dropped, and the only gun that would bear opened fire, but the submarine, apparently frightened by the explosion, had already commenced to submerge.

Realizing that a torpedo must inevitably follow, Captain Campbell ordered the surgeon to remove all wounded and conceal them in cabins; hoses were also turned on the poop, which was a mass of flames. A signal was sent out warning all men-of-war to divert all traffic below the horizon in order that nothing should interrupt the final phase of the action. Twenty minutes after a torpedo again struck the ship abaft the engine-room. An additional party of men were again sent away as a "panic party," and left the ship to all appearances completely abandoned, with the white ensign flying and the guns unmasked. For the succeeding 50 minutes the submarine examined the ship through her periscope. During this period boxes of cordite and shells exploded every few minutes, and fire on the poop still raged furiously. Captain Campbell and the handful of officers and men who remained on board lay hidden during this ordeal.

The submarine then rose to the surface astern, where no guns could bear and shelled the ship closely for 20 minutes. The enemy then submerged and steamed past the ship 150 yards off, examining her through the periscope. Captain Campbell decided to fire one of his torpedoes, but missed by a few inches. The submarine crossed the bows and came slowly down

the other side, whereupon a second torpedo was fired and missed again. The enemy observed it and immediately submerged. Urgent signals for assistance were immediately sent out, but pending arrival of assistance Captain Campbell arranged for a third "panic party" to jump overboard if necessary and leave one guns' crew on board for a final attempt to destroy the enemy, should he again attack. Almost immediately afterwards, British and American destroyers arrived on the scene, the wounded were transferred, the boats were recalled, and the fire extinguished. The *Dunraven*, although her stern was awash, was taken in tow, but the weather grew worse, and early the following morning she sank with colors flying.

(The award of the Victoria Cross to Lieut. Charles George Bonner, D. S. C., R. N. R., and P. O. Ernest Pitcher, O. N. 227,029 (Po.), was announced in *London Gazette*, November 2, 1917.)

H. M. Smack Nelson, August 15, 1917.—On August 15, 1917, the smack *Nelson* was engaged in fishing when she was attacked by gun fire from an enemy submarine. The gear was let go and the submarine's fire was returned. The submarine's fourth shot went through the port bow just below the waterline, and the seventh shell struck the skipper, Thomas Crisp, partially disembowelling him. and passed through the deck and out through the side of the ship. In spite of the terrible nature of his wound Skipper Crisp retained consciousness, and his first thought was to send off a message that he was being attacked and giving his position. He continued to command his ship until the ammunition was almost exhausted and the smack was sinking. He refused to be moved into the small boat when the rest of the crew were obliged to abandon the vessel as she sank, his last request being that he might be thrown overboard.

(The posthumous award of the Victoria Cross to Skipper Thomas Crisp, D. S. C., R. N. R., 10,055 D. A., was announced in *London Gazette*, November 2, 1917.)

H. M. S. Stock Force, July 30, 1918.—H. M. S. *Stock Force*, under the command of Lieut. Harold Auten, D. S. C., R. N. R., was torpedoed by an enemy submarine at 5 p. m. on July 30, 1918. The torpedo struck the ship abreast No. 1 hatch, entirely wrecking the fore part of the ship, including the bridge, and wounding three ratings. A tremendous shower of planks, unexploded shells, hatches, and other debris followed the explosion, wounding the first lieutenant (Lieut. E. J. Grey, R. N. R.) and the navigating officer (Lieut. L. E. Workman, R. N. R.) and adding to the injuries of the foremost gun's crew and a number of other ratings. The ship settled forward, flooding the foremost magazine and between decks to the depth of about three feet. "Panic party" in charge of Lieutenant Workman, R. N. R., immediately abandoned ship. and the wounded were removed to the lower deck, where the surgeon (Surg. Probationer G. E. Strahan, R. N. V. R.), working up to his waist in water, attended to their injuries. The captain, two guns' crews, and the engine-room staff remained at their posts.

The submarine then came to the surface ahead of the ship half a mile distant, and remained there a quarter of an hour, apparently watching the ship for any doubtful movement. The "panic party" in the boat accordingly commenced to row back towards the ship in an endeavor to decoy the submarine within range of the hidden guns. The submarine followed, coming slowly down the port side of the *Stock Force*, about 300 yards away. Lieutenant Auten, however, withheld his fire until she was abeam, when both of his guns could bear. Fire was opened at 5.40 p. m.; the first shot carried away one of the periscopes, the second round hit the conning tower, blowing it away and throwing the occupant high into the air. The next round struck the submarine on the waterline, tearing her open and blowing out a number of the crew.

The enemy then subsided several feet into the water and her bows rose. She thus presented a large and immobile target into which the *Stock Force* poured shell after shell until the submarine sank by the stern, leaving a quantity of debris on the water. During the whole of the action one man

(Officer's Steward, Second Class, R. J. Starling) remained pinned down under the foremost gun after the explosion of the torpedo, and remained there cheerfully and without complaint, although the ship was apparently sinking, until the end of the action. The *Stock Force* was a vessel of 360 tons, and despite the severity of the shock sustained by the officers and men when she was torpedoed, and the fact that her bows were almost obliterated, she was kept afloat by the exertions of her ship's company until 9.25 p. m. She then sank with colors flying, and the officers and men were taken off by two torpedo boats and a trawler.

The action was cited as one of the finest examples of coolness, discipline, and good organization in the history of the "Q" ships.

(The award of the Victoria Cross to Lieut. Harold Auten, D. S. C., R. N. R., was announced in *London Gazette*, September 14, 1918.)—*The Naval and Military Record*, 27/11/18.

BRITISH LOSS IN SUBMARINES.—*Fifty-nine During the War.*—Hitherto it has been impossible to publish the figures about British submarine losses during the war. Now the ban on publication is removed. The total British loss in submarines during the war was 59. These losses were distributed as follows:

By enemy action	39
Interned	3
Blown up by their crews in Russian harbors when the crews were withdrawn from Russia	7
Accidents (on trial, etc.)	4
Wrecked	1
Lost by collision	5
	59

The Admiralty have in preparation a full statement of British naval losses during the war in all descriptions of craft, and it will not be long before this is issued. The German loss in submarines was given some time ago as 202. Recently the Germans have disclosed another loss which they had concealed. The total German loss in submarines during the war was, therefore, 203.—*Engineering*.

NAVAL LOSSES.—H. M. S. *Cassandra* struck a mine in the Baltic, on the 4th December, just before midnight. Eleven men were lost—nine stokers, one mechanician, and one seaman. The remainder of the crew and officers were saved by destroyers. The *Cassandra* was a light cruiser of a new type, about 6,000 tons displacement, built and commissioned since the war began.—*Marine Engineer and Naval Architect*.

SWEDEN

WAR LOSSES OF SCANDINAVIAN COUNTRIES.—The losses of the Swedish merchant fleet from war casualties amount to 178 vessels, with an aggregate tonnage of 200,570 reg. tons gross. In all 248 lives have been lost. The loss of vessels represents 17 per cent of the country's total tonnage, while new construction and purchases have not been sufficient to make up for the losses. The losses of the Danish merchant fleet comprise 250 vessels, with an aggregate tonnage of 255,597 reg. tons gross. With the Norwegian losses amounting to the heavy total of 1,240,669 tons, the aggregate losses of the three Scandinavian countries come out at about 1,700,000 tons, whilst some recent English statistics gave the aggregate loss of all the neutral European countries as only 1,500,000 tons.—*Nautical Gazette*, 2/1.

SWEDISH WARSHIPS AS PASSENGER BOATS.—A proposal has been made by experts in Sweden to convert the two armored vessels of the F class,

Gustav V and *Drottning Victoria*, into high-speed passenger boats. These vessels are at present under construction. It is suggested that by the time they are finished the military-political situation will be such that Sweden will not need armed vessels of that type. In order that the money already expended on construction should not be entirely lost, it is proposed to turn them into passenger boats, to ply, for instance, between Gothenburg and Immingham. The vessels will be fitted up for 100 first-class, 119 second-class, and 119 third-class passengers. With 13,000 h. p. engines, a speed of 20 knots could be obtained, so that bv leaving Gothenburg at 8 a. m. the vessel would reach Immingham the following day. The vessels with their armor plates have a displacement of 7000 tons, but the removal of the plates would lighten them by 3500 tons; superstructure and fittings will weigh about 800 tons. The vessels should be able to take a cargo of 2000 tons.—11/12/1918.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, JANUARY 31, 1919

Type, number and name	Contractor	Per cent of completion			
		Feb. 1, 1919		Jan. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
42 Idaho	New York S. B. Co	99.1	99.1	98.5	98.5
43 Tennessee	New York Navy Yard	60.7	54.7	57.4	51.2
44 California	Mare Island Navy Yard	53.6	40.3	51.	36.4
45 Colorado	New York S. B. Co	6.8	.4	6.8	.4
46 Maryland	Newport News S. B. & D. D. Co	39.9	31.	38.9	28.8
47 Washington	New York S. B. Co	4.3	.4	4.3	.4
48 West Virginia	Newport News S. B. & D. D. Co	19.	2.1	18.8	2.1
49 South Dakota	Navy Yard, New York	0.	0.	0.	0.
50	Navy Yard, New York	0.	0.	0.	0.
51 Montana	Navy Yard, Mare Island	0.	0.	0.	0.
52 North Carolina	Navy Yard, Norfolk	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co	0.	0.	0.	0.
2 Constellation	Newport News S. B. & D. D. Co	0.	0.	0.	0.
3 Saratoga	New York S. B. Co	0.	0.	0.	0.
4 Ranger	Newport S. B. & D. D. Co	0.	0.	0.	0.
5 Constitution	Philadelphia Navy Yard	0.	0.	0.	0.
6	Phila. Navy Yard	0.	0.	0.	0.
Scout Cruisers					
4	Todd D. D. & Const. Co	24.5	11.5	24.4	10.5
5	Todd D. D. & Const. Co	22.	1.	21.9	.9
6	Todd D. D. & Const. Co	17.6	.6	17 6	.6
7	Union Iron Works	0.	0.	0.	0.
8	Union Iron Works	0.	0.	0.	0.
9	Wm. Cramp & Sons Co	9.	0.	9.	....
10	Wm. Cramp & Sons Co	9.	0.	9.	....
11	Wm. Cramp & Sons Co	0.	....	....	....
12	Wm. Cramp & Sons Co	0.	....	....	....
13	Wm. Cramp & Sons Co	0.	....	....	....
Miscellaneous					
Fuel Ship No. 16 Brazos	Boston Navy Yard	87.5	86.5	83.	82.
Fuel Ship No. 17	Boston Navy Yard	0.	0.	0.	0.
Fuel Ship No. 18	Boston Navy Yard	0.	0.	0.	0.
Gunboat No. 21	Asheville, Charleston Navy Yard	71.	70.	....	....
Gunboat No. 22	Asheville, Charleston Navy Yard	0.	0.	0.	0.
Hospital Ship No. 1	Philadelphia Navy Yard	24.	9.	24.	9.
Ammunition Ship No. 1	Puget Sound Navy Yard	66.	54.	60.	52.
Ammunition Ship No. 2	Puget Sound Navy Yard	12.5	0.	8.	0.

There are 212 destroyers, 73 submarines, 23 mine sweepers, 20 sea-going tugs, 40 harbor tugs, and 12 oil tankers in various stages of completion.

The *Cormorant*, an 1800-ton mine sweeper, was successfully launched this week from the Tebo Basin of the Todd Shipbuilding Corporation, Brooklyn, adding a fortieth vessel of its class to the United States Navy. It is a combination mine sweeper, mine layer, coast defence warship, carrying anti-aircraft guns, and having facilities for fire fighting and salvage work. An appeal for a bigger American merchant marine was the keynote of the brief launching speech of Congressman-elect Thomas H. Cullen, of Brooklyn. He was cheered by the 2,000 guests and workmen when he said that efforts to that end would be his chief object in the next session of Congress. The *Cormorant* is an oil burner, capable of making 15 knots, and cost $1,000,000. Almost exactly three months ago the keel was laid, and day and night shifts have worked on her. The *Cormorant* is a sister ship to the *Gannet*, to be launched from the same yard within three weeks. She is one of the eight ships to which the navy is giving bird names, all built at Todd's.—*Shipping*, 8/2.

GOVERNMENT TO PURCHASE $4,000,000 NAVAL BASE.—Cape May, N. J., Feb. 5.—Three hundred and forty-nine acres at this resort, the ground on which are erected the naval air station and the submarine patrol base building and barracks, have been taken over by the government.

Commander J. B. Patton, in charge of land for the Fourth Naval District, has notified the municipality to remove all its property from the reservation.

The price the government is to pay will be fixed by an appraisal board, if no agreement is reached between the Navy Department and the owners. About $4,000,000 is said to be the sum the owners ask.—*N. Y. Tribune*, 5/2.

ORGANIZATION OF THE AMERICAN FLEET SINCE RETURN FROM WAR AND VESSELS ASSIGNED FOR THE SPRING MANEUVERS.—Secretary Daniels authorizes the following statement on the organization of the fleet, completed since the return of American warships from service in European waters and in preparation for the spring maneuvers and battle practice in Cuban waters, for which the fleet sailed Tuesday, February 4.

Not all of the ships mentioned, however, will take part in the maneuvers, as the older battleships and cruisers and all other naval vessels available are helping to bring home American troops from France.

Organization of the Fleet.—The following tabulation shows the organization of the fleet by forces, squadrons, and divisions. It will be noted that the fleet is composed of two forces of battleships designated by Battleship Force No. 1 and Battleship Force No. 2. Then there is also a cruiser and transport force, a destroyer force, mine force, and a train, which is composed of the ships for fueling and supplying and repairing the fighting ships of the fleet. It will be noted that the forces of ships are composed of those ships of similar characteristics and mission. A force of ships is then divided into squadrons and divisions, a squadron being composed of two or more divisions and a division being composed of four or five ships. A vice admiral is assigned the command of a force and a rear admiral is assigned to the command of a squadron and division.

The organization of the Pacific and the Asiatic Fleets, with their commanding officers, is also shown.

The following is the organization of the Atlantic fleet: Admiral Henry T. Mayo, commander-in-chief; flagship of fleet, *Pennsylvania*, Capt. L. M. Nulton; fleet tender, *Despatch*.

Battleship Force No. 1.—Battleship Force No. 1, Vice Admiral A. W. Grant:

Division A, Rear Admiral C. B. Brittain: *Alabama*, Capt. V. A. Kimberly; *Illinois*, Capt. W. N. Jeffers; *Kentucky*, Capt. W. B. Wells; *Kearsarge*, Capt. G. E. Gelm.

Division B, Rear Admiral H. A. Wiley; *Iowa*, Capt. Edward C. Kalbfus; *Indiana*, Capt. George B. Landenberger; *Massachusetts*, Capt. John D. Wainwright.

Division No. 1, Rear Admiral Roger Welles; flagship *Missouri*, Capt. O. G. Murfin; *Ohio*, Capt. R. W. McNeely; *Maine*, Capt. R. C. Moody; *Wisconsin*, Capt. D. C. Wettengel.

Division No. 2, Rear Admiral Thomas Washington; flagship *Virginia*, Capt. H. G. Ziegemeier; *New Jersey*, Capt. J. K. Morton; *Rhode Island*, Capt. W. S. Crosley; *Nebraska*, Capt. D. W. Wurtsbough; *Georgia*, Capt. J. J. Raby.

Division No. 3, Rear Admiral W. R. Shoemaker; flagship *Connecticut*, Capt. J. F. Carter; *Louisiana*, Capt. G. R. Marvell; *Kansas*, Capt. A. W. Hinds; *New Hampshire*, Capt. Ridley McLean.

Division No. 4, Vice Admiral Albert W. Grant; flagship *Minnesota*, Capt. J. V. Chase; *Vermont*, Capt. F. H. Clark; *Michigan*, Capt. G. W. Laws; *South Carolina*, Capt. W. D. Brotherton.

Battleship Force No. 2.—Battleship force No. 2, Vice Admiral H. B. Wilson; squadron No. 3, Rear Admiral Hugh Rodman.

Division No. 5, Rear Admiral E. W. Eberle; flagship *Utah*, Capt. H. H. Hough; *Delaware*, Capt. C. F. Preston; *North Dakota*, Capt. T. J. Senn; *Florida*, Capt. M. M. Taylor.

Division No. 6, Rear Admiral Hugh Rodman; flagship *New York*, Capt. W. V. Prath; *Texas*, Capt. M. C. Twining; *Wyoming*, Capt. H. H. Christy; *Arkansas*, Capt. L. R. De Steiguer.

Division No. 7, Rear Admiral R. E. Coontz; flagship *Tennessee* (not yet in commission); *Idaho*, Capt. C. T. Vogelgesand; *Oklahoma*, Capt. C. B. McVay; *Nevada*, Capt. W. C. Cole.

Division No. 8, Vice Admiral H. B. Wilson; flagship *New Mexico*, Capt. L. A. Bostwick; *Arizona*, Capt. J. H. Dayton; *Mississippi*, Capt. W. A. Moffett; *Pennsylvania*, Capt. L. M. Milton.

The Cruiser Force.—Cruiser force, squadron 1, Vice Admiral Albert H. Gleaves.

Division No. 1, flagship *Seattle*, Capt. J. R. Y. Blakely; *North Carolina*, Capt. W. D. MacDougall; *Montana*, Capt. D. C. Day; *Huntington*, Capt. E. S. Kellogg.

Division No. 2, flagship *Pittsburg*, Capt. G. B. Bradshaw; *Pueblo*, Capt. F. B. Upham; *Frederick*, Capt. W. P. Scott; *South Dakota*, Capt. J. M. Luby.

Division No. 3, *Charleston*, Capt. W. L. Littlefield; *St. Louis*, Capt. G. D. Lincoln; *Rochester*, Capt. L. M. Overstreet.

The Destroyer Force.—Destroyer force, Rear Admiral C. P. Plunkett:

Flotilla A.—Division A, *Stewart, Whipple, Truxton, MacDonough, Worden*. Division B, *Paul Jones, Preble, Perry, Hopkins, Hull, Lawrence*. Division C, *Barry, Decatur, Dale, Bainbridge*. Division D, *Smith, Flusser, Lamson, Preston, Reid, Isabel*.

Flotilla B.—Division E, *Monaghan, Perkins, Walke, Sterrett, Mayrant, Warrington, Henley*. Division F, *Ammen, Burrows, Jarvis, McCall, Fanning, Patterson, Beale*. Division G.—*Jenkins, Jouett, Paulding, Drayton, Trippe, Roe, Terry*.

Flotilla No. 1, flagship *Birmingham:*

Group No. 1.—Division No. 1, *Cassin, Balch, Benham, Aylwin, Parker, Duncan, Downes*. Division No. 2, *Ericsson, O'Brien, McDougal, Winslow, Cushing, Nicholson*. Division No. 3, *Wadsworth, Conyngham, Tucker, Wainwright, Porter, Cummings*.

Flotilla No. 1:

Group No. 2.—Division No. 4, *Davis, Allen, Shaw, Wilkes, Sampson, Rowan*. Division No. 5, *Manley, Caldwell, Craven, Gwin, Connor, Stockton*. Division No. 6, *Little, Kimberly, Sigourney, Gregory, Stringham, Dyer*.

Group No. 3.—Division No. 7, *Colhoun, Stevens, McKee, Robinson, Ringgold, McKean.* Division No. 8, *Harding, Gridley, Fairfax, Taylor, Bell, Stribling.* Division No. 9, *Murray, Israel, Luce, Maury, Lansdale, Mahan.*

Flotilla No. 2.—Rear Admiral A. H. Robertson; flagship *Salem:*

Group No. 4.—Division No. 10, *Schley, Champlain, Mugford, Chew, Hazelwood, Williams.* Division No. 11, *Crane, Hart, Ingraham, Ludlow, 157, 158.* Division No. 12, *Lamberton, Radford, Montgomery, Breeze, Gamble, Ramsay.*

Group No. 5.—Division No. 13, *Wickes, Philip, Woolsey, Evans, Buchanan, Aaron Ward.* Division No. 14, *Rathbourne, Talbot, Waters, Dent, Dorsey, Lea.* Division No. 15, *Tarbell, Yarnell, Upshur, Greer, Elliott, Roper.*

Group No. 6.—Division No. 16, *Tattnall, Badger, Twiggs, Babbitt, Delong, Jacob Jones.* Division No. 17, *Boggs, Kilty, Kennison, Ward, Claxton, Hamilton.* Division No. 18, *159, 160, Palmer, Thatcher, Walker, Crosby.*

Flotilla No. 3, flagship *Chester:*

Group No. 7.—Division No. 19, *Breckenridge, Barney, Blakely, Biddle, Dupont, Bernadou.* Division No. 20, *154, 155, 156, 133, 134, Tillman.* Division No. 21, *Meredith, Bush, Cowell, Haddox, Foote, Rodgers.*

Group No. 8.—Division No. 22, *Burns, Anthony, Sproston, Rizal, McKenzie.* Division No. 23, *Renshaw, O'Bannon, Hogan, Howard, Stansbury.* Division No. 24, *Hopewell, Thomas, Haraden, Abbott, Bagley.*

Group No. 9.—Division No. 25, *Clemson, Dahlgren, Goldsborough, 189, 190, 191.* Division No. 26, *206, 207, 209, 210, 211.* Division No. 27, *Hatfield, Brooks, 233, 234, 235, 236.*

Group No. 10.—Division No. 28, *Belknap, McCook, McCalla, Kalk, Ingram.* Division No. 29, *257, 258, 259, 260, Delphy. McDermut.* Division No. 30, *Laub, McLanahan, Edwards, Greene, Ballard, Shubrick.*

Group No. 11.—Division No. 31, *Bailey, Thornton, Morris, Tingey, Swasey.* Division No. 32, *Chauncey, 297, Percival, 299, Farragut, Somers.* Division No. 33, *302, 303, 304, 305, 306, 307.*

The Mine Force.—Mine force, Rear Admiral Joseph Strauss:

Mine laying squadron—*San Francisco, Baltimore, Aroostook, Shawmut.*

Mine sweeping squadron.—Division No. 1, *Auk, Curlew, Grebe, Osprey, Pigeon, Woodcock.* Division No. 2, *Chewink, Cormorant, Lark, Mallard, Quail, Swan.* Division No. 3, *Ortolan, Partridge, Redwing, Sea Gull, Thrush, Whippoorwill.*

Train, Rear Admiral H. P. Huse, flagship *Supply.*

Store and ammunition ships, *Lebanon, Vestal.*

Hospital ships, *Comfort, Mercy, Solace.*

Supply ships, *Bridge, Culgoa.*

Fleet fuel ships, *Neptune, Jason, Jupiter, Orion, Cuyama, Maumee.*

Tugs, *Sonoma, Ontario, Patapsco, Patuxent, Lykens, Arapaho, Tavernilla, Gorgona, Chemung, Wando, Uncas.*

Organization of Pacific Fleet.—Commander-in-chief, Admiral W. B. Caperton.

Division No. 1, Rear Admiral C. S. Williams; flagship *Pittsburgh, Denver, Cleveland, Tacoma.*

Division No. 2, Rear Admiral W. F. Fullam; flagship *Minneapolis, Oregon, Vicksburg, Rainier, Broadbill, Bay Ocean, Challenge, Marblehead, Forward, Yorktown.*

Auxiliaries *Glacier, Brutus, Nanshan, Saturn, Iroquois.*

Submarine chasers, *303, 304, 305, 306.*

Organization of Asiatic Fleet.—Commander-in-chief, Rear Admiral W. L. Rodgers.

Squadron No. 1, Division No. 1, flagship *Brooklyn, New Orleans, Albany.* Division No. 2, *Helena, Wilmington, Sacramento, Dubuque, Paducah.*

Division No. 3, *El Cano, Pampango, Villalobos, Quiros, Palos, Samar, Monocacy.*

Submarine division, *Monadnock, A-2, A-3, A-4, A-5, A-6, A-7, B-1, B-2, B-3.*

Auxiliaries, *Ajax, Piscataqua, Abarenda, Pompey.*

Naval stations, Cavite and Olongapo, P. I.

Station ships, *Cavite, Mohican.*

Yard craft, *Wompatuck, General Alava.*

Santo Domingo, *Potomac, Kwasink, Dorothea.*

St. Thomas, *Vixen.*

Porto Rico, *CTB No. 6.*

Guantanamo, *Osceola.*

Ponta Delgada, *Margaret, Tonopah.*

Pearl Harbor, *Monterey.*

Bermuda, *Tallahassee, Sea Rover, Mohave.*

Annapolis, *Wasp.*

RECORD OF THE U. S. NAVY GUNS IN FRANCE.—How satisfactorily the five U. S. Navy railway batteries performed in the Argonne sector in France until the very last minute of the great war can now be told. The 14-inch 50 caliber guns fired a total of 782 rounds, as follows:

Battery No. 1	199
Battery No. 2	113
Battery No. 3	236
Battery No. 4	122
Battery No. 5	112
Total	782

The objectives fired at and the rounds follow:

Longuyon	147
Mengiennes	50
Montmedy	328
Laon	199
Mortiers	35
Beny-Loisy	22
Tergnier	1

Battery No. 1 operated with the 10th French Army from September 10 to October 24, and with the 8th French Army from November 5 to November 11. No. 2 operated with the 10th French Army from August 24 to October 6, and with the 1st French Army from October 6 to October 24. From October 24 to November 5 this battery was with the 1st American Army, then going to the 8th French Army and operating with it until the signing of the armistice. Batteries Nos. 3, 4 and 5 operated only with the 1st American Army. The distinction of firing the first shot upon Tergnir fell to Battery No. 2, located at Rethondes, on September 6, 1918. The range was 40,853 yards which was the maximum range at which the navy railway batteries were called upon to fire during their operations. In firing this first shot Battery No. 2 occupied a position on a siding, the identical place occupied by the train carrying Marshal Foch and his staff when the armistice was signed.

In only three per cent of all the firings was it possible to conduct successful aerial observations. The maximum rate of fire reached was in firing a few rounds at intervals of three minutes and fifty seconds. Practically all firing was done at irregular intervals in order to confuse the enemy. The dispersion was less than 50 yards and the accuracy of the guns was considered satisfactory even after as many as 200 rounds had been fired. When hostilities ceased Laon, Montmedy and Longuyon were inspected and it was found that where the shots had fallen, in spite of the fact that no

spotting had been possible the hits had been accurate and very destructive. The last shot from the guns was fired at 10.59 a. m., on November 11, from gun No. 4, located at Thierville and firing on Longuyon.—*Army and Navy Journal*, 1/2.

NINETY-SEVEN THOUSAND AND THIRTY-NINE PERSONS BROUGHT TO U. S. BY NAVAL VESSELS IN JANUARY.—*Twelve Thousand One Hundred and Ninety-two Carried by Cruisers and 7528 by Battleships, Report Shows.*—Secretary Daniels authorizes the following:

The Navy Department has received a report from the commander of the cruiser force (Atlantic) showing the number of troops brought back to the United States during January by American vessels, including the battleships and cruisers in transport service. These figures do not include the troops brought back in ships belonging to other nations:

The report follows:

"Ninety-seven thousand and thirty-nine passengers were returned to the United States by ships of cruiser and transport force during January. Of this number, 12,192 were carried by cruisers and 7528 by battleships. The total rated capacity of vessels arriving was 105,593.—*Official Bulletin*, 7/2.

SINKING OF THE "TICONDEROGA."—Secretary Daniels authorizes the following statement in regard to the action of the U. S. S. *Galveston* when the U. S. S. *Ticonderoga* was sunk by a German submarine on the morning of September 30, 1918, the statement being based on the report of the commanding officer of the U. S. S. *Galveston:*

On the morning of September 30, 1918, the U. S. S. *Galveston* was acting as escort for a convoy of about 14 vessels bound for England.

The convoy was about 1400 miles off the English coast, the *Galveston* at that time being ahead and on right flank of the convoy and the course being about northeast. An army cargo ship, *Feltore*, was known to be about two miles south of the convoy.

Changed Course and Opened Fire.—A short time before daylight, about 5 a. m., the *Galveston* saw a gun flash on the starboard bow distant about five or six miles; she changed course and ran toward the flash and opened fire with 5-inch guns. It was thought at first that the *Feltore* was being attacked, but this soon proved to be not so. A few minutes after opening fire the *Galveston* saw a second set of gun flashes which were very close together and made it dangerous to continue firing, due to the possibility of hitting a friendly vessel, and immediately after the cessation of the gun flashes the *Galveston* ceased firing.

Thought It Westbound Ship.—The *Galveston* did not know that the *Ticonderoga* had fallen out of convoy and supposed that the vessel attacked was probably a westbound empty merchant vessel.

It was noticed that a fire broke out on the vessel, but it appeared that the fire was soon extinguished.

Returned to Her Position.—The *Galveston* returned to her position with the convoy, and after checking up the ships it was found that the *Ticonderoga* was missing, and it was then supposed that the attack had been made on the *Ticonderoga*.

The commanding officer states that due to the large number of men in the engineer's force who were sick with influenza it had been necessary to reduce his boiler power, and if he remained absent from the convoy any great length of time he would be unable to rejoin, and the submarine would therefore have good opportunity of attacking the other vessels of the convoy.

That he did not know the ship attacked was from his convoy, and that it was his first duty to remain with the large number of ships in the convoy rather than to remain longer with the ships being attacked, and that he thought she had a chance to escape.

Quotes General Instructions.—The commanding officer states that his general instructions were that "if one or more ships in convoy are torpedoed or mined the ocean escort is to proceed with her convoy."

The report from the survivors of the *Ticonderoga* state that during the night of September 29 and 30 the *Ticonderoga* had fallen out of her position in the convoy due to difficulty in maintaining steam sufficient to keep up her speed.

A court of inquiry is in session to investigate occurrences on the *Ticonderoga.—Official Bulletin, 27/1.*

"S. C.-28" UNDER SAIL REACHES PORT.—The Navy Department has allowed the story of the mishap to *S. C.-28* and her subsequent troubles to be told. This chaser was turned over to the French and started out in convoy to cross the Atlantic. She left the Bermudas on January 7, 1918, and the fleet soon ran into very heavy weather. In a storm on January 12 the fleet scattered and *S. C.-28* lost sight of her companions.

The little craft had suffered severely. Heavy seas had swept over her, carrying away ventilators, boxes of coal and gasolene; the lifeboat was torn from its davits, the crew's mess table aft was lifted and partially demolished, the china swept off and broken. The engine-room was flooded, but the crew managed to start one engine and kept the boat going. The weather moderated, and the *28* set out to rejoin the convoy. But she had more engine trouble, and there was a shortage of lubricating oil. For two days she sent out signals for aid, but could get no assistance.

On February 18 the chaser put into the Azores and then Alexis Puluhen, her master, told of the experiences of himself and his crew. The story which follows reads like a sea yarn.

"The machinists set to work to fix the engines, and on Wednesday, January 16, at midnight, the central engine started up. I set course east. There was nothing in sight. At 3 a. m. we again broke down. At 3.30 a. m. I saw the lights of two steamers to port on the horizon, headed east. I showed two red lights at the masthead and signaled to them with the blinker. They did not answer me and continued on their course to the east.

"At 11.50 a. m. I saw the mast of a scout boat on the horizon to the northwest. Considering my boat to be in a critical condition by reason of the length of time it had been disabled and the near exhaustion of my lubricating oil, I fired a salvo of six shots and hoisted the signal of distress. I obtained no answer. At noon the center engine started up; course east. Nothing in sight. At 1 p. m. a new breakdown of the engine. The chief machinist, Faignou, reported to me that the lubricating oil was all gone. Thereupon I used soapsuds and several greasy substances to replace the oil, but these gave bad results.

"I then gave all the salad oil and butter for the lubrication of the engines. These latter gave very good results, but were not sufficient. There were about five gallons. At 5.40 p. m. the center engine started up; course east, nothing in sight.

"At 11.30 p. m. another and last breakdown of the engine and burning out of the dynamo. The chief machinist reported to me that he would not be able to make the engines run any more. The radio would not work. It was impossible for me to call for help. There was nothing left me aboard but several pints of salad oil, which I used only for the lubrication of the auxiliary engine with which I pumped bilges.

"I found myself, therefore, in complete distress, drifting toward the southeast, at the mercy of the winds and sea, with no exact position.

"I remained in this condition until the 18th of February without getting help of any kind. I ordered a jury lug rig to be got up, pumping the bilges all the time, putting out and taking in a sea-anchor when I thought it well to use it. Sparing the drinking water as much as possible, ration-

ing the crew to the lowest possible amount, in view of the probability of a long voyage; putting out and taking in the sails according to the condition of the weather and the direction of the wind, and endeavoring to make headway east by compass in an effort to reach the Azores.

"I sighted four steamers, of which three were very far away and making a course nearly parallel to mine, so that they did not approach very near to me. They probably did not see me.

"On February 8, at 9.30 a. m., I saw the third steamer about four points to port and crossing our course not far away. The weather was fine, the sea very beautiful. I at once hoisted signals of distress and got out the lifeboat, manned by two volunteers, and ordered it to get in the path of the steamer and speak to him, but when he arrived at a distance of about five miles and was bearing about two points forward of the port beam, the steamer changed course suddenly and put on all steam. I immediately fired a salvo of seven guns at intervals of one minute, in accordance with the rules for distress signals, but he did not answer me and continued to run away. At 11.15 a. m. he disappeared over the horizon, heading about southwest.

"I had at this time a fore-and-aft mainsail, a staysail and a kind of leg-of-mutton at the small foremast. At 11.20 I hoisted in the lifeboat and continued to sail toward the east. I am certain that the steamer saw me clearly. I could not recognize her name or nationality.

"The conduct of the crew was marvelous throughout the voyage. They retained at all times their habitual calm. They never complained of the smallness of the ration which it was necessary for me to restrict them to, and thereby showed a grand spirit of sacrifice and self-denial.

"On February 18, at 6.30 a. m., I saw land one point on the port bow, bearing north 55° east by compass. I headed over and took a sounding from time to time. At 11.00 a. m. I hoisted the signal 'YP'—'I require a tug.'

"At 3.25 the *Sin-Mac* took me in tow about five miles southwest of Fayal and brought me into the port of Horta.

"The winding of the dynamo armature was burned out in two places. The electric wiring was all very badly grounded. The ship needs to be caulked and cleaned on the bottom. The depth-bomb rack and skids need to be rebuilt, but the other damage is slight. Part of the crew's clothing was damaged by the water and dampness.

"The coal for the galley was all expended by January 26. The galley fire was made from the wood of the broken mess table and benches. I estimate that I might have held out for 20 days longer, but not more than that, because all the provisions and water would have been gone by that time."—*The Rudder*, January.

REPORT ON U. S. S. "NARRAGANSETT."—The Navy Department has received the following supplementary report on the U. S. S. *Narragansett*, which went ashore on Isle of Wight at midnight January 31:

"*Narragansett* went ashore on ledge near Bembridge, Isle of Wight, Culver Point bearing 238° true. Ship struck within hour of high tide. Rise and fall of tide about 13 feet. At low water the vessel is out of water forward to amidships; stern in 12 feet of water; stern well afloat at high water, but resting on ledge amidships.

"No inside punctures and compartments dry; ship has been lightened every possible way. Two thousand one hundred and fifty troops removed with no casualties.

"Admiralty salvage equipments scarce as all available material is working at Ostend and Zeebrugge. Now attempting to block up forward at low water so that at high tide the ship will lift off ledge amidships and possibly be floated. Investigating."—*Official Bulletin*, 10/2.

ORDNANCE AND GUNNERY

HAMMOND'S RADIO-CONTROLLED TORPEDO IS SUCCESS.—The wireless-controlled torpedo invented by John Hays Hammond, Jr., was reported a success by army and navy experts to-day. The report was made public following a series of tests carried out in connection with the new fortifications appropriation bill. The experts predict equally successful results with submerged craft on which only the wireless antennæ will be above water. The new bill carries an appropriation of $417,000 for the construction of an experimental submerged boat.

The tests just completed before the army and navy experts are the outcome of nine years of experimental work on the device by Mr. Hammond. Their reported success follows hard upon the declaration made by Dr. Lee De Forest and other wireless experts that the device was useless.

The Hammond invention consists of a high-powered motor boat carrying 1000 pounds of high explosives. This vessel is run, stopped, controlled and directed entirely by wireless apparatus on shore or on an aeroplane. It is the claim of the inventor that the boat can be directed in such a manner that it would destroy any enemy warship approaching the coast defences or harbors.

In tests made off Gloucester, Mass., the boat successfully struck a bamboo rod one inch in diameter standing upright out of the water, ten times out of fifteen at a distance of three and one-half miles from the starting point.

The invention has been developed along two lines. One of these comprises a surface vessel of the sled type capable of a speed of 50 miles an hour. The other consists of a submerged craft with an underwater speed of 27 knots an hour. The extreme range of these two types is said to be eight miles.

It is for the complete development of the submerged type that the appropriation of $417,000 is asked.

The first attempts to control the Hammond torpedo from an aeroplane were made in October, 1916. At that time a special Burgess-Dunne biplane was equipped with the controlling device and piloted by Lieutenant Sheppley W. Fitzgerald. The results were never made public.

Mr. Hammond first achieved success with his device shortly before the outbreak of the war. At that time his apparatus was installed on the motor yacht *Natalie*. This strange craft, zigzagging across the harbor without a soul aboard, quickly acquired wide attention, and in November, 1914, an army commission consisting of Colonel R. P. Davis, Captain Francis J. Behr and Lieutenant S. M. Decker was sent down to observe its operation.

There then followed four years of tests under army and navy supervision.

In 1916 a bill was introduced in Congress to appropriate $1,167,000 for the purchase of the Hammond patents. This led to attacks by leading experts who declared the invention impracticable.

It is upon the tests just completed that the acceptance of the invention depends, according to a statement by an officer in the Department of Ordnance.—*N. Y. Tribune*, 15/2.

THORNYCROFT DEPTH CHARGE THROWERS.—By the courtesy of Messrs. Thornycroft we are now enabled to reproduce in the accompanying engravings some photographs which are of especial interest. One of them shows a thrower with and without the carrier and depth charge in the firing position. In still another, which was taken from the deck of a destroyer, two depth charges with their carriers may be seen in the air at the same moment, while the fourth engraving shows the result of the explosion of one of the charges.

It may be explained, for the information of the uninitiated, that depth charges are sinking mines carrying high explosives, and fitted with a hydro-statically operated mechanism which can be adjusted to detonate the explosive when the mine has sunk to any desired depth of immersion. When thev were first used it was customary simply to drop them overboard from a staging on the counter, the boat from which they were dropped relying upon its speed to get out of the way before the explosion occurred. As a matter of fact it did not always succeed in getting clear, with the result there were cases in which considerable damage was done. Moreover, is was a by no means satisfactory method of procedure for several reasons, among them being the difficulty of dropping the charge exactly in the place where it would be most effective. Hence it was deemed desirable to introduce some method by means of which the charge could be thrown clear of the vessel and caused to drop more or less in the required position, and the solution of this problem, as arrived at by Messrs. Thornycroft, was the production of the depth charge thrower.

The detonating mechanism of the depth charge is so delicate that it was out of the question to subject its container to such a direct shock as would have been caused by the explosion of a propulsive charge in immediate contact with it, and it was decided instead to apply the principle which

FIG. 2—Thrower, Carrier, and Depth Charge.

FIG. 3—Depth Charge in Firing Position.

Messrs. Thornycroft had worked out for the discharge of torpedoes from small motor boats. How it was done was briefly discussed in our issue of last week, and we shall now proceed to amplify what we then said.

The general form of the thrower is well shown in the illustrations. The mortar barrel in the first design was made of steel, but it was recognized, later, that with the low pressure employment in it, it would be quite safe to use cast iron, thus going back to very early artillery practice. The use of that material considerably speeded up the rate of production at a time when rapid delivery was of first class importance. In all cases the barrel has a fixed inclination of 50 degrees to the horizontal, that elevation, with the charge employed, giving a range of some 40 yards, which is all that is required. The actual pressure employed in the barrel is only some 600 pounds to the square inch, and for such a comparatively low pressure as that the walls, even when made of cast iron, do not have to be of excessive thickness.

To produce such a low pressure as 600 pounds per square inch necessitated, of course, special arrangements. Our standard propulsive explosive—cordite—needs for its proper explosive combustion a pressure of at least from 1½ to 2 tons per square inch. Such a high pressure as that would have been out of the question, for, besides being much higher than was required to perform the work in hand, its effect on the carrier would have been very

similar to that caused by a severe blow, and might conceivably have caused the premature detonation of the depth charge. What was done, therefore, was to arrange the propulsive charge in a container inside an explosion chamber, and to connect the latter with the bottom of the barrel by means of a comparatively restricted orifice. The propulsive charge container is a closed vessel, saving that it is perforated with a series of small holes. On the cordite being detonated a high pressure is immediately set up, and the gases of combustion have first of all to make their way through the small holes into the combustion chamber, in which a certain amount of expansion takes place. The gases are then wiredrawn through the orifice connecting with the bottom of the barrel, with the result that the pressure in the latter only rises comparatively slowly, and the projectile—in this case the carrier with its charge—is only subjected to something which is far better described as a push than a blow. The actual charge employed is, moreover, quite small, being only that contained in an ordinary pom-pom cartridge; that is to say, about four ounces of cordite. The results obtained

FIG. 4—Depth Charges and Carriers in Flight.

have been almost without exception satisfactory. There have, we believe, only been two or three instances in which premature explosions of the depth charge have occurred, and in those cases the cause has not been directly traceable to the method of firing.

The cartridge container and the explosion chamber, which have to withstand much higher pressures than the barrel, are of course made of steel. Each of them is cylindrical in form, and the former is screwed into the latter. For firing the cartridge a special form of pistol is employed. It consists of a plunger round which is arranged a coiled spring. When in the ready-for-firing position the plunger is drawn from its casing for a short distance—this operation compressing the spring—and is held there by a wedge. Firing is brought about by releasing the wedge, which can be done from a distance in any direction by means of a lanyard.

For throwing the depth charges what are called carriers are employed. They consist of cradles of metal plate bent so as to hold the depth charge cases, each having attached to it a stalk or plunger which descends nearly to the bottom of and is a fairly loose fit in the barrel. The barrels of the

throwers are, we may say, bored true within a limit of twenty thousandths of an inch, and the carriers are supplied within a limit of plus and minus fifteen thousandths; with the barrel to the smallest limits and the carrier to the largest, there should still be a clearance between the barrel and the cylindrical part of the carrier of 0.030 inches. When first made the plungers were constructed of wood treated with paraffin wax to prevent them from swelling when they got damp. Subsequently, however, they were made of metal plate which has been found more satisfactory, since they are not, of course, affected by moisture. They necessarily conform to the same dimensions and weight as those of the wooden pattern. It will be observed that in the muzzle of the barrel there are two notches. They are for the purpose of receiving two lugs formed on the carrier, their object being to prevent the plunger from revolving in the barrel. For sea stowage, lashings from the ring bolts in the ends of the depth charge container are secured to the eyes on the sides of the thrower, or perhaps to the deck of the vessel. The thrower is usually kept ready for immediate use, and there is an indicator on the side of the pistol which shows whether or not there is a cartridge in the container. A safety bolt passes across the top end of the hammer, and it is provided with a padlock, so that the firing wedge cannot be withdrawn until it has been unlocked and the pin removed. In order to prevent an accumulation of water in the barrel, as might easily happen in a rough sea, a drainhole three-sixteenths of an inch in diameter is provided in the bottom of the barrel. This hole is always left open, and while it does not affect the working of the weapon, it effectively allows of the escape of the water.—*The Engineer*, 24/1.

THE TORPEDOPLANE OF REALITY.—Ever since Rear Admiral Bradley A. Fiske, U. S. N., patented the torpedoplane back in July, 1912, this form of naval weapon has received some attention on the part of naval men. But it has remained for the British and the Germans to give the idea an actual tryout, and this they did during the last years of the great war.

The torpedoplane is nothing more than an airplane or seaplane arranged to carry one or more torpedoes which it can launch at surface targets from a distance of several hundred yards, to ensure accuracy of aim. The British have constructed torpedoplanes in which a single torpedo is carried between the floats or wheels, depending on whether the craft is a seaplane or landplane. In some instances the torpedoplanes have single engines, while in others they have been of the powerful twin-engine model.

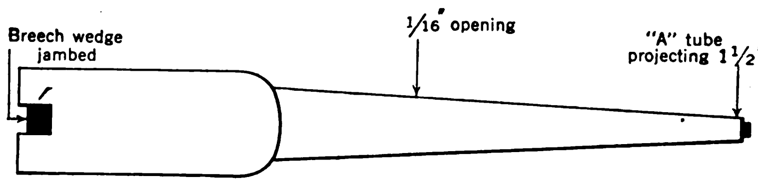
British naval officers sank two ships during 1916 by means of torpedoplanes. The Germans retaliated by sinking the British steamship *Gena* by means of one of their torpedoplanes. However, the war ended before either side could try out the torpedoplane on an extensive scale, hence the efficiency of this naval weapon is still a matter for conjecture. It is understood that a single torpedo weighing about 2,000 pounds is generally carried. More torpedoes mean a larger machine, which in turn means a better mark for the enemy gunners. Hence the single-torpedo type seems the best for the purpose.—*Scientific American*, 2/1.

LEUGENBOOM GUN.—From description by Commander G. L. Schuyler, U. S. Navy. The gun described is the Leugenboom gun which bombarded Dunkirk in the fall of 1917 and which was later captured by the British. Upon inquiry from the Admiralty, it has been learned that the gun is now in Belgian hands. The description gives brief information concerning some of the details and particularly of the method of demolition attempted. The pneumatic run-out cylinder, the heavy balance weight and the range graduation corresponding to angles of elevation of 51° are interesting. The range on the scale is considerably less than 50,300 yards which was credited to this gun by British artillery officers at the time the bombardments were being conducted. This discrepancy is possibly accounted for by the remark that it is not the same gun as was at first used, or possibly an improved projectile was fired.

No definite information as yet has been obtained as to the caliber of the gun.

In all cases the Germans have been very thorough in their demolition work, and although the results at Leugenboom are not so spectacular, they have rendered the gun there useless for firing, in our opinion.

The method of demolition they appear to have generally employed was to give the gun depression which brought the muzzle within a foot or two of the concrete emplacement in front. The gun was secured in the run-out position by securing chains, the air recuperator run-out cylinder probably emptied and a powerful charge exploded inside the gun which was tamped by some object that would not have had clearance to leave the muzzle before taking against the concrete of the emplacement. In the case of the Leugenboom gun, the explosion sheared the securing chains and forced the gun back into the run-in position where it now remains. The tamping broke up the concrete emplacement in front and set the "A" tube forward, and this latter now projects 1½ inches from the muzzle. The "B" tube, which had a joint at about one-third of its length from front end of jacket to muzzle, has also come forward leaving a one-sixteenth-inch opening at the joint. The force of the explosion has also so strained the breech ring that all efforts up to date have failed in opening the wedge.



This particular mounting seems to have suffered very little, however, and is in a much better state than any of the four at Deutschland Battery (Jakobinessen).

General Description of Gun and Mounting at Leugenboom.—The gun is the usual 45-caliber naval gun.

The rifling has 100 grooves and except for two of the lands being flattened for six inches from the muzzle is in good condition and bears out the statement of the natives that the gun was not the original one first mounted at Leugenboom.

The mounting is nothing more or less than a large central pivot mounting with the weight of the overhanging portion of the side girders taken on a roller path on the rear wall of the emplacement. This mounting differed from those at the Deutschland battery in being enclosed by a shield of 2½-inch armor plates similar in form to our ordinary transferable mounting shields.

The elevating gear consisted in double screw gear with male and female thread, actuated either by motor or hand gear situated on the right side of the mounting, the hand gear being manned from the well of the gun pit.

There was no evidence to show whether the hand gear was used for fine adjustment after the gun had first been laid by the electric gear, or merely as an alternatiave.

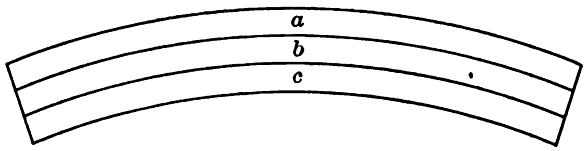
The training gear was also by hand or electric means, and was carried on the left side of the mounting. The motion was imparted to a pinion situated in the center of the rear overhanging portion of the mounting and gearing into a circular-toothed rack on the rear of the emplacement. This rack was formed by two angle-bars secured together by studs which formed the teeth of the rack.

Recoil and Run-Out Arrangements.—The gun is carried in a cylindrical cradle through which it recoils. There are two recoil cylinders and one pneumatic run-out cylinder, all of which are part of the cradle and do not recoil with the gun.

The run-out control is apparently contained in the run-out cylinder and probably consists of a plunger such as is used in many of our transferable mountings.

The lug is extended downwards and fitted with rubbing strips which slide on the top and sides of the run-out cylinder, which is square externally. This is a feature not met with in our service and is a very useful one in resisting the torque due to the rifling and in steadying the gun during recoil. It is not, however, applicable to guns mounted on slides as are our guns of 12 inches and above. A very heavy balance weight is fitted to the top of the cradle in the vicinity of the trunnions. This is obviously to improve the balance at high elevations, and is probably not fitted to similar mountings on board ship.

The laying arrangements consisted in an arc carried over the right trunnion and secured to the cradle with the pointer on the fixed structure. This arc carried three scales—



(a) Graduated in degrees from 0° to 55°.
(b) Graduated in range (meters) up to 38700 which corresponded to 51° .43'.
(c) Graduated in range (meters) up to 34200 which corresponded to 49° .34'.

Arc of training, 157° with centre line of arc pointing approximately at Dunkerane.

Loading by small bogies which could be pushed on to platform at rear of revolving structure and clipped in position whilst loading.

No signs of any apparatus for heating up charges.

Pump could apparently clear well of water or be used for flooding magazines. Air for run-out cylinder was stored in bottles and there was a connection for flexible lead at rear end of cylinder at bottom.

Entrance could not be obtained to the magazines at Leubenboom.

On the left side of the mounting there was a bracket for carrying a trainer's sight (secured to the fixed structure) for checking on a reference mark.

NAVIGATION AND RADIO

CURVED OR " S " COURSES.—*A Protection Against Torpedo and Gunfire.*—Early in the war ships were accustomed to steer a straight course and formed an easy mark for the submarine; but in 1915 all the allied nations adopted a method of steering on zigzag courses, and this proved to be probably the most effective of all the many devices to elude the torpedo. During the course of the war, Mr. Lindell T. Bates, secretary of the Submarine Defence Association, devised and patented a method for enabling ships to steer on continuous curved courses, in which there would be no straight course whatsoever. This method is an improvement upon the zigzag course and is a logical development of its principles. The Submarine Defence Association recently went on record with the statement that " This more than any other invention of the war time will aid

submarine defence and profoundly affect coast defence, armament and naval tactics."

In order to reach a torpedo firing position, the submarine must submerge at a considerable distance and proceed under-water until she comes within firing distance. This firing distance should be not over a thousand yards. Indeed, during the war, because of the difficulty of hitting, the German U-boats are said to have received instructions, if possible, to get within 300 yards before letting go. At a range within 1000 yards, if the torpedo is fired before the vessel puts her helm over, there is but little chance for her to avoid being hit.

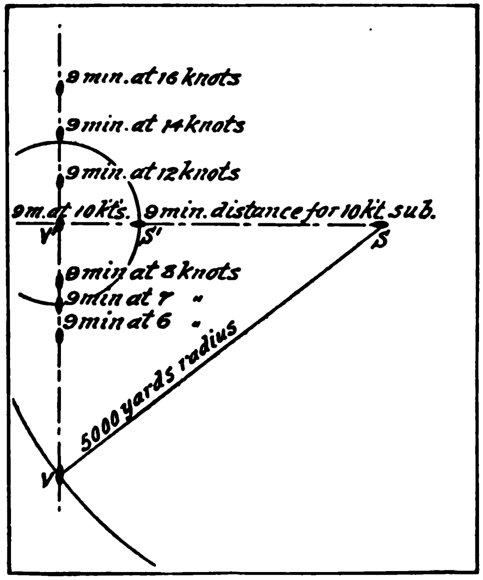


FIG. 1.—Effect of Error in Speed—Estimate on Submarine's Maneuver for Position.

For a torpedo firing position within a 1000-yard range to be reached and a torpedo to be aimed with accuracy, the submarine captain must learn three things: (1) the course on which the vessel is steaming; (2) her speed; (3) and the range or the distance between submarine and ship. With this data the problem becomes simply one of the solution of triangles, in which the bearings and range of the ship and U-boat, speed of the ship and the torpedo, and the angle of torpedo fire, are utilized. The object of this calculation is to fire the torpedo at a point ahead of the ship so that it will cross the ship's course at the time when the ship reaches that point.

Effect of Miscalculation of the Ship's Course, Speed and Distance.—The effect upon the success of a submarine's maneuver for position of an error in estimating the course, speed or range of the vessel, may be very important. As may be seen from Fig. 3, an error in course—estimate of from 10 to 20 degrees, in a direction which carries the vessel toward the U-boat while the latter, submerged, is approaching the 1000-yard firing position—may result in the submarine, on emerging to make corrections finding itself so near the ship, that it will have to remain under

water to escape gunfire and the depth bomb. If the submarine makes an error in course-estimate which carries the vessel away from the submarine, the latter on emerging will be so far from the ship as to be outside of torpedo range. If the submarine overestimates the speed of the

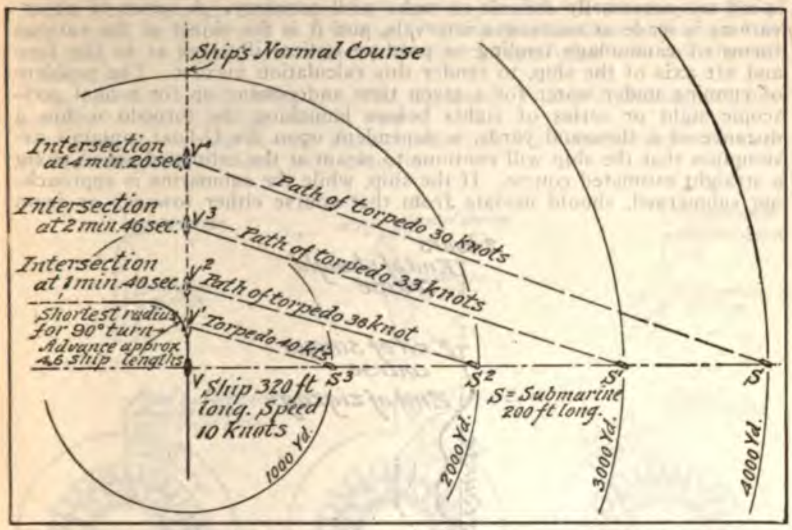


FIG. 2.—Path of the Torpedo When Fired at Various Ranges.
(Note.—In These Three Drawings S, S′ &c. = Submarine; v, v′ &c. = the Ship.)

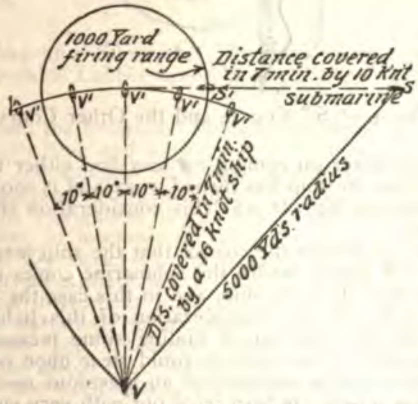


FIG. 3.—Effect of Error in Course—Estimate on Submarine's Maneuver for Position.

vessel, it can upon coming up for observation await the ship's arrival or maneuver closer, but if the U-boat underestimates the ship's speed, she will on emerging find that the ship has passed the desired firing position. This will be clear from Fig. 1. If the range or distance to the sub-

marine has been underestimated, the opportunity for torpedo attack may be lost. A serious over-estimation of the distance may bring the submarine too close and expose her to being rammed and sunk by fire and depth bombs.

Now the estimation of the course upon which a ship is steaming and its speed are necessarily difficult to make with certainty. A series of observations is made at successive intervals, and it is the object of the various forms of camouflage tending to produce optical illusions as to the fore and aft axis of the ship, to render this calculation inexact. The problem of running under water for a given time and coming up for a final periscopic sight or series of sights before launching the torpedo within a distance of a thousand yards, is dependent upon the U-boat captain's assumption that the ship will continue to steam at the estimated speed along a straight estimated course. If the ship, while the submarine is approaching submerged, should deviate from that course either towards or from

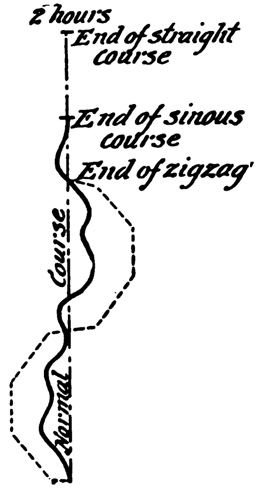


FIG. 4.—" S " Course and the Other Courses.

the submarine, the latter on coming up may find either that she has overshot the ship or that the ship has turned away and is too far away for any certainty of making a hit. It was this consideration that led to the use of zigzag courses.

There is, however, always the chance that the ship may not have started on a new leg of the zigzag before the submarine comes up for verification of her position and that of the ship, and in this case the chances of hitting the target are good. It was consideration of this liability that led Mr. Bates to work on the problem of finding some means by which ships, whether one ship or a whole convoy, could steer upon courses, no part of which was straight, and he worked out an ingenious mechanism for steering curved courses, which has been tried out with very encouraging results.

The types of courses adopted are designed to permit of the greatest speed and distance of travel for the ship with the largest immunity from torpedo or gunfire hits, and it consists of a succession of simple or compound graduated spiral arcs, so arranged that the curves melt into one another. Such spirals are selected as are of sufficient curvature to confuse observation by the U-boat, or by the gunnery officer of a warship or fort, and yet will be such as will not too much retard a vessel or cause her

to lose too much distance as compared with a straight course. The embarrassment of a submarine captain in attempting to determine the course, speed and range of a vessel that is steaming on a curve will be evident. The problem is difficult enough when the vessel is steaming on a straight course, and from a distant submarine the angle of departure of a curved course is practically impossible of determination.

During a long course of experiments in curved-course steaming, it was found that the retardation on the curved course with the easy angle of helm used, at all times is less than the whole retardation for a vessel steaming on a zigzag course in which the changes of course are through a large arc.

Automatic-Course Indicator.—The automatic course indicator was prepared with the following ends in view:

1. To enable a ship to steer zigzags, scientific "S" courses, spiral curves, or combinations of them, with precision.

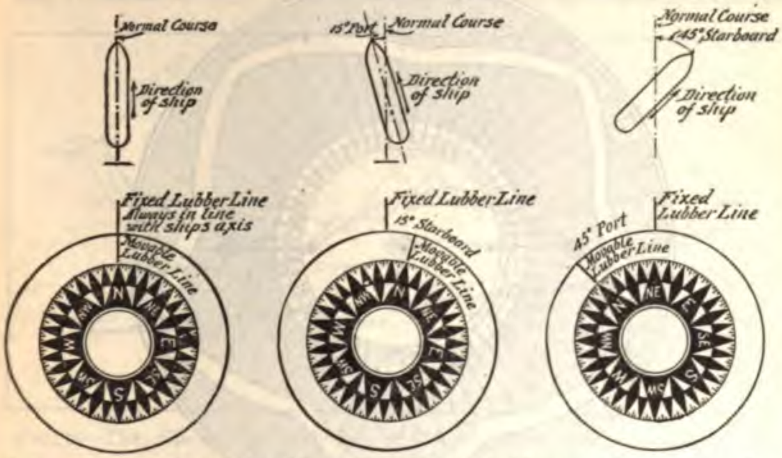


FIG. 5.—These Diagrams Show the Effect of Change of Position of a Moveable Lubber-Line Upon a Ship's Course.

2. To impose upon the helmsman in such navigation no duty in addition to the one to which time and experience have accustomed him—namely, that of watching the compass and maintaining in alinement on it the normal compass-mark with a lubber-line.

3. To supply the navigation officer and helmsman at all times with definite information, in intervals of time and units of distance, relative to the position of the vessel on the zigzag, "S" course, or curve, and relative to the normal straight course.

4. To provide an instrument suited to any vessel, whatever her speed, and whatever her variations in speed, her size and other characteristics, and adaptable to any type of compass, magnetic or gyroscopic.

Ships are now navigated by using the helm so that what is known as a "lubber-line" on the fixed compass rim, which line is set in line with the vessel's longitudinal axis, is kept opposite a selected compass mark on the compass card. Thus if a vessel proceeding north be desired to go east the helmsman turns the ship until the east mark of the compass is opposite the lubber-line. If, however, the lubber-line were not set in line with the ship's axis, but were positioned on the fixed compass rim, say 15 degrees to the right or starboard of the longitudinal axis of the ship,

then the vessel would not be steering north, but 15 degrees to the west of north. Conversely, if the lubber-line were moved to the left or port and the vessel were turned accordingly, the ship would be found to be heading east of that compass direction, the same number of degrees as the line was moved to the left of the longitudinal axis line of the ship.

The principle of the course indicator is as follows: A lubber-line is marked on a rim which is rotatable about the compass card. If the line is moved to the left or right of the axis of the ship, then by causing the selected compass mark to follow it, the ship will go to starboard or port respectively. The helmsman to-day looks at a given course mark on the compass and keeps it opposite a fixed lubber-line. With the automatic course indicator, the helmsman keeps the same normal compass mark opposite a lubber-line which is movable. The movement of the lubber-line is brought about by means of a grooved cam as shown in our illus-

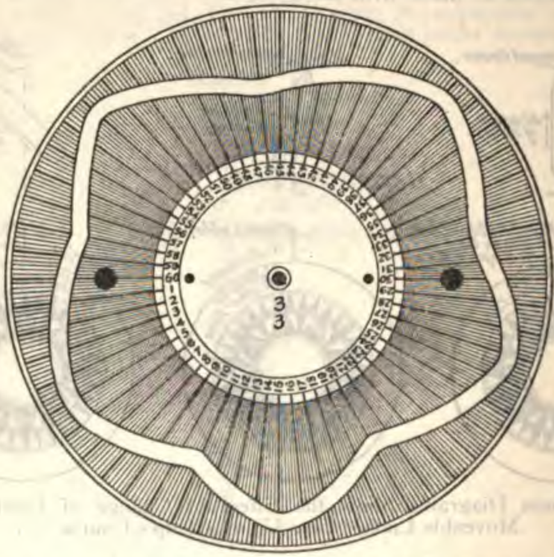


FIG. 6.—This Cam Acting on Movable Lubber-Line Produces a Curved Course.

tration, Fig. 6. The cam, which is contained within the binnacle, is rotated by means of a small electric motor. It is evident that by cutting the cam to correspond with the curve or "S" course which the ship is to follow, the ship will automatically, because of the movements transmitted to the lubber-line from the cam, steer the desired course. A ship will carry several of these cams for as many different courses as may be desired.

Curved Courses and Gunfire.—The value of the curved course as a protection against gunfire, whether from an enemy ship or a shore emplacement, will be evident at once, and Mr. Bates has published a description of the employment of the course indicator, during a special maneuver of a ship, made before a certain coast fortification with the permission of the military authorities. The description of this interesting test follows:

"Mortars are the main coast defense reliance. It is publicly known that they are generally fired in view of three observations, taken at 0 seconds, 30 seconds and 1 minute. The angles and ranges noted on these occasions

are used, with corrections, to locate the so-called 'prediction point' at the 2d minute and the 'set-forward point,' which adds the time of flight of the projectile, and is the point at which the shell is aimed to fall. In the case of mortar fire, with its high trajectory, this is between 45 seconds and 1 minute for most ranges. *It is the pratice to calculate, therefore, for mortar fire, the future position of a vessel from one and three-quarters to two minutes ahead.* On a straight course the prediction and set-forward points come close to the vessel's actual course. Figure 7 shows this fact for ranges between 8000 and 9000 yards. Inspection of the results shows an average error of 35 yards. In regard to sinuous courses at the same range one finds for a cam course called S I an average range error in the set-forward point of about 90 yards in range and 15 yards in deflection. On inspecting Cam 3 course one finds the errors are very great in the determination of the set-forward point. The Cam 3 course run at 8000 yards range shows average errors in the location of the set-forward point of 175 yards longitudinally, and 110 yards literally. These errors are what may be ordinarily expected

FIG. 7.—This Shows the Difficulty of Hitting a Ship That is Sailing on a Curved or "S" Course.

It also shows the course as estimated by observers in a land fort; and the point of fall of shells (see dotted line and circles) fired at the ship. It shows the difficulty of predicting the point at which a ship will be when the shell strikes. This difficulty is due mainly to the fact that the gunner's estimates of the future position of the ship are based upon the erroneous assumption that she is sailing on straight courses.

in mortar firing at a vessel steering an "S" course. The sinuous course causes a loss in hitting power of mortar batteries of about 50 per cent, so that only high velocity rifles should be used in future installations, confining the use of mortars to special cases. The result of these tests demonstrated the vulnerability of coast defenses armed with mortars when bombarded at long range by warships steering a sinuous bombardment curve. As a result of the invention of the Automatic Course Indicator the firing system and armament o fcoast defences will have to be radically revised.

"In regard to gunfire, a lesser but very material error is introduced. In the case of 12-inch guns the prediction interval is only 30 seconds and time of flight from 15 to 30 seconds. The error appears to be proportional or nearly so to the time interval at which the future position of the ship on the 'S' course must be guessed. On a straight course the average error in the set-forward point is about 24 yards. With the target head-on when steering

an 'S' course, at ranges between 7000 and 12,000 yards, the total probability of hitting is reduced by 25 per cent and with the target broadside the sinuous course at 8000 yards range reduces the longitudinal probability of hitting about 10 per cent. At the longer ranges, 18,000 and 21,000 yards, the sinuous course will give an attacking fleet more immunity than now from rifle fire. When spotfiring is resorted to the error will be far greater even than that indicated above.

"The importance of these tests cannot be too strongly emphasized. As the mortar and gunfire from a land battery having a long horizontal and high vertical base line, at 8000 yards range, was seriously affected, how much more will be the effect upon gunfiring between battle fleets at 18,000 yards range which resort to spotfiring! A fleet on an 'S' course will be much more immune from the enemy's guns, while her own control officers, knowing the 'S' course, can alter their ship's fire as the curve changes."—*Scientific American*, 25/1.

ENGINEERING

A NEW EXPERIMENTAL TANK.—In a recent issue of *De Ingenieur*, Mr. J. K. E. Triebart describes a new apparatus which avoids the great expense of building a Froude experimental tank. This provides for the model of the ship to remain stationary in a tank of moderate size, and allows water to flow through the tank in such a manner that the velocity may be regulated, while the pressure exerted on the model can be accurately measured. Although not claiming that this apparatus will entirely supersede the Froude tank, owing to experiments on large-size models not being possible, the author states that it has certain advantages which make it possible to observe the cavitation and other phenomena of rapidly revolving screw propellers that it is impossible to observe in the Froude tank. He further claims that the moderate cost of this tank and the small working cost bring it within the reach of small shipbuilding concerns, the results also being sufficiently accurate for most purposes. The idea, of course, is not new so far as this country is concerned.—*The Shipbuilder*, January.

FULL-SIZED SHIP EXPERIMENTS.—Numerous cases are on record where good results have been obtained by alterations made to full-sized ships after they have been completed, says "Naval Architect" in the *Times Engineering Supplemnt*. Trial trips have been run both before and after the alterations, and in this way a trustworthy estimate has been made of the difference in performance.

At the spring meetings of the naval architects last year Sir E. Tennyson d'Eyncourt, for instance, recalled the case of two ships built about 17 years ago. After they had been in service for some time he suggested that the bossing, which was nearly horizontal, was not at a suitable angle. On one of the ships coming back to the works it was, therefore, decided to alter the angle to something approaching 45 degrees, and, in addition, the casting was fined at the aft end as well as the lines of the bossing itself. At higher speeds much better results were obtained than with the old horizontal bossing, but the improvement did not maintain itself at lower speeds. This showed that the improvement was due to the angle of the bossing and not to the general fining of the lines. After the ship had been on service for some time it was found that so much coal had been saved that her sister ship was sent to have a similar alteration made to her bossing.

Bilge Keels.—Sir Archibald Denny at the Northeast Coast Institution of Engineers and Shipbuilders in November, 1915, instanced a rather curious case of alterations made to a full-sized ship where it was found that the bad performance of the vessel was not due to the suspected cause but to something entirely different. When the vessel was built, her bilge keels, which were very long, were not put on normal to the bilge, as they would have come out of water at the ends, the angle of the diagonal plane of the

keel being reduced. When the vessel was tried on the measured mile her efficiency was found to be very low. Some one suggested that the bilge keels were the cause of the trouble, and a length of 20 feet was cut off from each end of both of them. This causing no appreciable difference, the bilge keels were taken off altogether, and the reduction in the resistance was found as nearly as possible to be quite normal.

Later it was seen that there was a lack of surface in the propellers, and when new propellers were put on the efficiency came up to expectations. This, however, did not explain the fact that in an almost identical ship with similar propellers proper results had been obtained, and Sir Archibald Denny has stated that to this day he is not able to explain with certainty why the results were so different. Another case quoted by him was that of a channel steamer. In order to get the maximum result, mastic was placed behind each butt and washed off into the general surface, and this was done for some years, but when the mastic cracked off it was not replaced, because there was no apparent difference in the speed on service with or without it.

Alterations in Propellers.—Admiral Taylor, in his "Speed and Power of Ships," refers to the steamer *Niagara*, a yacht about 250 feet long, in which the shaft brackets were nearly horizontal. She was given two 6-hour trials under similar conditions. In the first the screws were inward-turning and in the second were interchanged to be outward-turning. The horsepower developed on each trial was very nearly the same, but with the inward-turning screws the average speed was 12.8 knots, whereas it was 14.12 knots with outward-turning screws.

Captain Dyson, the propeller designer to the American Navy, has instanced a case of two oil-fuel barges built for the Navy Department. These vessels were designed for a speed of six knots, and everything indicated that the speed could be easily obtained with the power. After trying several different propellers, however, the highest speed realized was only 5¼ knots. It was thought that the action of the water indicated that a portion of the feed was being drawn from astern, and as the cheapest remedy the line of shafting was changed so as to lower the propeller about 3 feet, although the lower blade projected below the line of keel. In this new position, with propellers of the same pitch and surface but of 6-inch greater diameter, a speed of 6¼ knots was obtained with the same power as before. The greater portion of this increase in efficiency of the propeller was due to increase in diameter, and the remainder to the change in position, but the increase in diameter was rendered possible by the lowering of the shaft.

Many other examples could be given, but those mentioned are sufficient to show the benefits that may be derived by making alterations in consequence of careful observation of a ship's behavior in service. The cost of carrying out the alterations must vary, and in some cases will no doubt amount to a fair figure. On the other hand, the large saving brought about by the reduced fuel consumption, which operates during the whole lifetime of a ship, will more than balance even a considerable outlay on such alterations. When this is generally realized it can be confidently stated that enormous economies will be effected in ship propulsion.—*Shipping*, 1/2.

AERONAUTICS

THE CROSSING OF THE ATLANTIC BY AIR.—The developments in aeronautics have been so rapid, owing to the impetus given by war conditions, that the question of establishing connection between the various continents, in particular between America and Europe, would seem to be within measurable distance. The public interest has latterly been roused by the press, both technical and otherwise, in this possibility—but whilst the case of the aeroplane has been very often referred to with a view to use after the war for commercial purposes, mention is seldom made of the possibilities of the lighter than air means of aerial locomotion. This is probably due to the fact that the capabilities of airships are not so well known as in the case

of aeroplanes. It will be readily understood from the considerations put forth in the following notes, that whilst the crossing of the Atlantic by aeroplane is a very difficult performance, unless special intermediate stages are provided, a modern airship is capable of negotiating the distance with ease. In fact, if Zeppelins had been built in America, instead of Germany, it is quite likely that the Atlantic would have been crossed by air at any time since 1915, when the 60-ton modern Zeppelin made its appearance.

The two factors which put the airship in such a favorable position for such long distance work are: (1) The low value of the traction co-efficient of an airship as compared with an aeroplane; (2) The capability of the airship of cruising at a moderate speed with a very small percentage of its power.

The speed of an aeroplane that would most likely be used for this purpose would be about 90 miles per hour, whilst an airship designed for this purpose would have a speed of about 65 miles per hour. Now, the traction co-efficient of the aeroplane at 90 miles per hour would be 16 per cent, whilst that of an airship would not exceed 5 per cent at 65 miles per hour, and would be less at lower cruising speeds.

If we take 30 per cent of the gross weight of the machine as fuel in both cases, and $3 \cdot 2 \times 10^6$ ft.-lb. of energy available per pound of fuel, after allowing for propeller efficiency, we find that:

In the case of the aeroplane:

Total energy carried as fuel $= \cdot 3 \times W \times 3 \cdot 2 \times 10^6$ ft.-lb.

Resistance $= .16$ W.

$\therefore$ Maximum possible non-stop flights

$$= \frac{\cdot 3 \times W \times 3 \cdot 2 \times 10^6}{.16\ W} = \frac{.3 \times 3 \cdot 2\ 10^6}{.16 \times 5280} \text{ miles} = 1136 \text{ miles.}$$

In the case of the airship:

$$\frac{\cdot 3 \times 3 \cdot 2 \times 10^6}{\cdot 5 \times 5280} \text{miles} = 3430 \text{ miles.}$$

the range of the airship being over three times that of the aeroplane.

It will be seen that the range is inversely proportional to the traction co-efficient of the aerial machine, provided the same proportion of the engine fuel to gross weight is carried in both cases.

It may be argued that 30 per cent of the gross lift is high, but it has been assumed that special arrangements would be made to ensure a maximum amount of fuel, and that every sacrifice would be made in other respects to satisfy the special conditions for long-range flights.

Lanchester gives a value of traction co-efficient of 10 per cent as being the minimum limit of possibility for an aeroplane that might be designed in the future with special precautions to reduce the resistance to a minimum, the speed being taken at 90 miles per hour. Under these conditions, and with 33 per cent of gross weight as fuel, he calculates that the possible non-stop flight for an aeroplane is 2000 miles. This figure could, no doubt, be improved upon by using a slower speed, but other considerations would probably render this course inadvisable.

Since the distance to be covered is nearly 2000 miles, we may definitely state that attempts at non-stop crossing of the Atlantic can only be regarded as freak performances, and that any serious attempt to establish flying routes across this ocean must involve, at least, one calling station *en route*. Particularly would this be apparent if an attempt were made to cross from Europe to America, as in this case the general easterly drift of the atmosphere would have to be encountered. This drift of the atmosphere may make it possible to make a non-stop flight from America to Europe, but before we can say that a fiying route has been established, we should reckon upon the return journey being possible.

The position of a modern airship is much more favorable and is such that even with existing Zeppelin airships, given reasonable conditions and carry-

ing not more than 25 per cent of their own gross weight as fuel, the non-stop flight could be accomplished either way, particularly if advantage were taken of cruising, say, at half-speed, utilizing only about one-eighth of its power, and consequently effecting economies in fuel used per mile.

Under these conditions of cruising at half-speed and carrying 25 per cent of the gross lift as fuel, we find that the maximum non-stop flight is equal to:

$$\frac{\cdot 25\,W \times 3\cdot 2 \times 10^{6}}{\frac{\cdot 5\,W}{4} \times 5280} = 11{,}430 \text{ miles.}$$

The enormous advantage of an airship for long-distance flight is at once evident.

The following are the chief characteristics of an aeroplane and an airship that could be used with present-day knowledge and development for an attempt to cross the Atlantic in one continuous flight (of 2000 miles) from America to Europe.

	Aeroplane	Airship
Gross weight or lift	8 tons.	60 tons.
Useful lift	3·5 tons.	22 tons.
Maximum speed	90 m. p. h.	65 m. p. h.
Power	1200 h. p.	1500 h. p.
Weight of fuel	3 tons.	15 tons.

Aeroplane

Assuming that in ordinary circumstances, the engine power actually used would not exceed 1000 h. p. in order to economize fuel—

Fuel required per hour ....500 lb.

$\therefore$ hours of flight $= \frac{3 \times 2240}{500} = 13\cdot 4$ hours.

Neglecting the slightly reduced speed the distance covered in 13.4 hours $= 13.4 \times 90 = 1206$ miles.

With an atmospheric drift of 30 m. p. h. assisting we have the total possible distance $= 1206 + 402 = 1608$ miles.

So that unless the assistance from wind were greater, the attempt would fail.

Airship

Fuel required at full power per hour = 150 lb.

$\therefore$ hours of flight at full speed $= \frac{15 \times 2240}{750} = 47$ hours.

47 hours at 65 m. p. h. = 3050 miles.

The flight could therefore be accomplished without having recourse to cruising at low power and reduced speed and without the aid of assisting winds.

N. B.—It is impossible that the useful lift would be 30 tons and the fuel carried 20 tons, thus increasing the range in proportion to nearly 4000 miles, and therefore capable of the non-stop double journey.

Assuming that conditions for the aeroplane were highly favorable and the journey from America to Europe were just accomplished, we see that owing to the atmospheric drift being against the direction of flight the return journey would be impossible under present conditions of design and performance.

With the airship, owing to its lower maximum speed, there would also be considerable difficulty in effecting the return journey if adverse winds were high, say, over 40 miles per hour. In this case, the effective speed would only be 25 miles per hour at full power, and the time of flight required would be about 80 hours, and the journey could not be accomplished. If flight were made at half-power, and the speed reduced to 52 miles per hour, the effective speed would be 12 miles per hour, and the journey

would take 166 hours, whilst the maximum time possible under these conditions would be 84 hours.

Cruising at reduced power against this adverse wind is, therefore, not helpful. The journey, however, could be accomplished if adverse wind did not exceed 20 miles per hour, as in this case the effective speed would be 45 miles per hour, and the time taken 44·5 hours, which is within the capabilities of the ship.—*Engineering*, 3/1.

CURRENT NAVAL AND PROFESSIONAL PAPERS

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ENGINEERING. **January 10.**—Progress in Turbine Ship Propulsion.

DIPLOMATIC NOTES

FROM JANUARY 20 TO FEBRUARY 20

PREPARED BY

ALLAN WESTCOTT, PH. D., Instructor, U. S. Naval Academy

LEAGUE OF NATIONS CONSTITUTION PUBLISHED

The constitution for a League of Nations, having been completed and unanimously approved by the representatives of 14 nations engaged in its preparation, was presented by President Wilson at a plenary session of the Peace Conference on February 14. In his speech the President declared that the document was "not a strait-jacket, but a vehicle of life," which, however, provided definite guarantees of peace and machinery for coöperation in any international matter.

Briefly, the plan provides: 1, a body of delegates from each of the signatory powers, each nation having one vote; 2, an executive council of nine, representing the five great powers and four others to be chosen in rotation; 3, a secretariat and a permanent capital or seat of meeting; 4, no resort to war on the part of any signatory without either arbitration or inquiry by the Executive Council, and then not until three months after action taken by the arbitrators or the Council; 5, combined economic, financial, and military action against a covenant-breaking state; 6, reduction and limitation of armaments to a figure determined by the Executive Council; 7, control of former German colonies and of regions with weak governments by more advanced states acting as mandatories for the League; 8, guarantees of the territorial integrity and political independence of all signatories.

TEXT OF PROPOSED CONSTITUTION.—Following is the text of the covenant and draft of the Constitution of the League of Nations as read by President Wilson to the plenary session of the Peace Conference to-day:

COVENANT

PREAMBLE—In order to promote international coöperation and to secure international peace and security by the acceptance of obligations not to resort to war, by the prescription of open, just and honorable relations between nations, by the firm establishment of the understandings of international law as the actual rule of conduct among governments, and by the maintenance of justice and a scrupulous respect for all treaty obligations in the dealings of organized people with one another, the powers signatory to this covenant adopt this constitution of the League of Nations:

ARTICLE I

The action of the high contracting parties under the terms of this covenant shall be effected through the instrumentality of a meeting of a

body of delegates representing the high contracting parties, of meetings at more frequent intervals of an Executive Council, and of a permanent international secretariat to be established at the seat of the League.

ARTICLE II

Meetings of the body of delegates shall be held at stated intervals and from time to time, as occasion may require, for the purpose of dealing with matters within the sphere of action of the League. Meetings of the body of delegates shall be held at the seat of the League, or at such other places as may be found convenient, and shall consist of representatives of the high contracting parties. Each of the high contracting parties shall have one vote, but may have not more than three representatives.

ARTICLE III

The Executive Council shall consist of representatives of the United States of America, the British Empire, France, Italy, and Japan, together with representatives of four other states, members of the League. The selection of these four states shall be made by the body of delegates on such principles and in such manner as they think fit. Pending the appointment of these representatives of the other states, representatives of ——— shall be members of the Executive Council.

Meetings of the council shall be held from time to time as occasion may require, and at least once a year, at whatever place may be decided on, or, failing any such decision, at the seat of the League, and any matter within the sphere of action of the League or affecting the peace of the world may be dealt with at such meetings.

Invitations shall be sent to any power to attend a meeting of the council, at which such matters directly affecting its interests are to be discussed, and no decision taken at any meeting will be binding on such powers unless so invited.

ARTICLE IV

All matters of procedure at meetings of the body of delegates or the Executive Council, including the appointment of committees to investigate particular matters, shall be regulated by the body of delegates or the Executive Council, and may be decided by a majority of the states represented at the meeting.

The first meeting of the body of delegates and of the Executive Council shall be summoned by the President of the United States of America.

ARTICLE V

The permanent secretariat of the League shall be established at ———, which shall constitute the seat of the League. The secretariat shall comprise such secretaries and staff as may be required, under the general direction and control of a Secretary General of the League, who shall be chosen by the Executive Council. The secretariat shall be appointed by the Secretary General subject to confirmation by the Executive Council.

The secretary general shall act in that capacity at all meetings of the body of delegates or of the Executive Council.

The expenses of the secretariat shall be borne by the states members of the League, in accordance with the apportionment of the expenses of the International Bureau of the Universal Postal Union.

ARTICLE VI

Representatives of the high contracting parties and officials of the League, when engaged in the business of the League, shall enjoy diplomatic privileges and immunities, and the buildings occupied by the League or its officials, or by representatives attending its meetings, shall enjoy the benefits of extraterritoriality.

ARTICLE VII

Admission to the League of states, not signatories to the covenant and not named in the protocol hereto as states to be invited to adhere to the covenant, requires the assent of not less than two-thirds of the states represented in the body of delegates, and shall be limited to fully self-governing countries, including dominions and colonies.

No state shall be admitted to the League unless it is able to give effective guarantees of its sincere intention to observe its international obligations and unless it shall conform to such principles as may be prescribed by the League in regard to its naval and military forces and armaments.

ARTICLE VIII

The high contracting parties recognize the principle that the maintenance of peace will require the reduction of national armaments to the lowest point consistent with national safety, and the enforcement by common action of international obligations, having special regard to the geographical situation and circumstances of each state, and the Executive Council shall formulate plans for effecting such reduction. The Executive Council shall also determine for the consideration and action of the several governments what military equipment and armament is fair and reasonable in proportion to the scale of forces laid down in the program of disarmament; and these limits, when adopted, shall not be exceeded without the permission of the Executive Council.

The high contracting parties agree that the manufacture by private enterprise of munitions and implements of war lends itself to grave objections, and direct the Executive Council to advise how the evil effects attendant upon such manufacture can be prevented, due regard being had to the necessities of those countries which are not able to manufacture for themselves the munitions and implements of war necessary for their safety.

The high contracting parties undertake in no way to conceal from each other the condition of such of their industries as are capable of being adapted to warlike purposes or the scale of their armaments, and agree that there shall be full and frank interchange of information as to their military and naval programs.

ARTICLE IX

A permanent commission shall be constituted to advise the League on the execution of the provisions of Article VIII, and on military and naval questions generally.

ARTICLE X

The high contracting parties shall undertake to respect and preserve as against external aggression the territorial integrity and existing political independence of all states members of the League. In case of any such aggression or in case of any threat or danger of such aggression the Executive Council shall advise upon the means by which the obligation shall be fulfilled.

ARTICLE XI

Any war or threat of war, whether immediately affecting any of the high contracting parties or not, is hereby declared a matter of concern to the League, and the high contracting parties reserve the right to take any action that may be deemed wise and effectual to safeguard the peace of nations.

It is hereby also declared and agreed to be the friendly right of each of the high contracting parties to draw the attention of the body of delegates or of the Executive Council to any circumstance affecting international intercourse which threatens to disturb international peace or the good understanding between nations upon which peace depends.

ARTICLE XII

The high contracting parties agree that should disputes arise between them which cannot be adjusted by the ordinary processes of diplomacy, they will in no case resort to war without previously submitting the questions and matters involved either to arbitration or to inquiry by the Executive Council and until three months after the award by the arbitrators or a recommendation by the Executive Council, and that they will not even then resort to war as against a member of the League which complies with the award of the arbitrators or the recommendation of the Executive Council.

In any case under this article the award of the arbitrators shall be made within a reasonable time, and the recommendation of the Executive Council shall be made within six months after the submission of the dispute.

ARTICLE XIII

The high contracting parties agree that whenever any dispute or difficulty shall arise between them, which they recognize to be suitable for submission to arbitration and which cannot be satisfactorily settled by diplomacy, they will submit the whole matter to arbitration. For this purpose the court of arbitration to which the case is referred shall be the court agreed on by the parties or stipulated in any convention existing between them. The high contracting parties agree that they will carry out in full good faith any award that may be rendered. In the event of any failure to carry out the award the Executive Council shall propose what steps can best be taken to give effect thereto.

ARTICLE XIV

The Executive Council shall formulate plans for the establishment of a permanent court of international justice, and this court shall, when established, be competent to hear and determine any matter which the parties recognized as suitable for submission to it for arbitration under the foregoing article.

ARTICLE XV

If there should arise between states, members of the League, any dispute likely to lead to rupture, which is not submitted to arbitration as above, the high contracting parties agree that they will refer the matter to the Executive Council; either party to the dispute may give notice of the existence of the dispute to the secretary general, who will make all necessary arrangements for a full investigation and consideration thereof. For this purpose the parties agree to communicate to the secretary general, as promptly as possible, statements of their case, with all the relevant facts and papers, and the Executive Council may forthwith direct the publication thereof.

Where the efforts of the council lead to the settlement of the dispute, a statement shall be published, indicating the nature of the dispute and the terms of settlement, together with such explanations as may be appropriate. If the dispute has not been settled, a report by the council shall be published, setting forth with all necessary facts and explanations the recommendation which the council think just and proper for the settlement of the dispute. If the report is unanimously agreed to by the members of the council, other than the parties to the dispute, the high contracting parties agree that they will not go to war with any party which complies with the recommendations, and that, if any party shall refuse so to comply the council shall propose measures necessary to give effect to the recommendations. If no such unanimous report can be made it shall be the duty of the majority and the privilege of the minority to issue statements, indicating what they believe to be the facts, and containing the reasons which they consider to be just and proper.

The Executive Council may in any case under this article refer the dispute to the body of delegates. The dispute shall be so referred at the request of either party to the dispute, provided that such request must be made within 14 days after the submission of the dispute. In a case, referred to the body of delegates, all the provisions of this article, and of Article XII, relating to the action and powers of the Executive Council, shall apply to the action and powers of the body of delegates.

ARTICLE XVI

Should any of the high contracting parties break or disregard its covenants under Article XII, it shall thereby *ipso facto* be deemed to have committed an act of war against all the other members of the League, which hereby undertakes immediately to subject it to the severance of all trade or financial relations, the prohibition of all intercourse between their nationals and the nationals of the covenant-breaking state and the prevention of all financial, commercial, or personal intercourse between the nationals of the covenant-breaking state and the nationals of any other state, whether a member of the League or not.

It shall be the duty of the Executive Council in such case to recommend what effective military or naval force the members of the League shall severally contribute to the armed forces to be used to protect the covenants of the League.

The high contracting parties agree, further, that they will mutually support one another in the financial and economic measures which may be taken under this article in order to minimize the loss and inconvenience resulting from the above measures, and that they will mutually support one another in resisting any special measures aimed at one of their number by the covenant-breaking State and that they will afford passage through their territory to the forces of any of the high contracting parties who are coöperating to protect the covenants of the League.

ARTICLE XVII

In the event of dispute between one state member of the League and another state which is not a member of the League, or between states not members of the League, the high contracting parties agree that the state or states, not members of the League, shall be invited to accept the obligations of membership in the League for the purposes of such dispute, upon such conditions as the Executive Council may deem just, and upon acceptance of any such invitation, the above provisions shall be applied with such modifications as may be deemed necessary by the League.

Upon such invitation being given the Executive Council shall immediately institute an inquiry into the circumstances and merits of the dispute and recommend such action as may seem best and most effectual in the circumstances.

In the event of a power so invited refusing to accept the obligations of membership in the League for the purposes of the League, which in the case of a state member of the League would constitute a breach of Article XII, the provisions of Article XVI shall be applicable as against the state taking such action.

If both parties to the dispute, when so invited, refuse to accept the obligations of membership in the League for the purpose of such dispute, the Executive Council may take such action and make such recommendations as will prevent hostilities and will result in the settlement of the dispute.

ARTICLE XVIII

The high contracting parties agree that the League shall be intrusted with general supervision of the trade in arms and ammunition with the countries in which the control of this traffic is necessary in the common interest.

ARTICLE XIX

To those colonies and territories which, as a consequence of the late war, have ceased to be under the sovereignty of the states which formerly governed them and which are inhabited by peoples not yet able to stand by themselves under the strenuous conditions of the modern world, there should be applied the principle that the well being and development of such peoples form a sacred trust of civilization and that securities for the performance of this trust should be embodied in the constitution of the League.

The best method of giving practical effect to this principle is that the tutelage of such peoples should be intrusted to advanced nations, who by reason of their resources, their experience, or their geographical position, can best undertake this responsibility, and that this tutelage should be exercised by them as mandatories on behalf of the League.

The character of the mandate must differ according to the stage of the development of the people, the geographical situation of the territory, its economic conditions and other similar circumstances.

Certain communities, formerly belonging to the Turkish Empire, have reached a stage of development where their existence as independent nations can be provisionally recognized, subject to the rendering of administrative advice and assistance by a mandatory power until such time as they are able to stand alone. The wishes of these communities must be a principal consideration in the selection of the mandatory power.

Other peoples, especially those of Central Africa, are at such a stage that the mandatory must be responsible for the administration of the territory, subject to conditions which will guarantee freedom of conscience or religion, subject only to the maintenance of public order and morals, the prohibition of abuses such as the slave trade, the arms traffic, and the liquor traffic, and the prevention of the establishment of fortifications or military and naval bases and of military training of the natives for other than police purposes and the defense of territory, and will also secure equal opportunities for the trade and commerce of other members of the League.

There are territories, such as Southwest Africa and certain of the South Pacific Isles, which, owing to the sparseness of the population, or their small size, or their remoteness from the centres of civilization, or their geographical contiguity to the mandatory state and other circumstances, can be best administered under the laws of the mandatory states as integral portions thereof, subject to the safeguards above mentioned in the interests of the indigenous population.

In every case of mandate, the mandatory state shall render to the League an annual report in reference to the territory committed to its charge.

The degree of authority, control, or administration, to be exercised by the mandatory state, shall, if not previously agreed upon by the high contracting parties in each case, be explicitly defined by the Executive Council in a special act or charter.

The high contracting parties further agree to establish at the seat of the League a mandatory commission to receive and examine the annual reports of the mandatory powers, and to assist the League in insuring the observance of the terms of all mandates.

ARTICLE XX

The high contracting parties will endeavor to secure and maintain fair and humane conditions of labor for men, women, and children, both in their own countries and in all countries to which their commercial and industrial relations extend; and to that end agree to establish as part of the organization of the League a permanent bureau of labor.

ARTICLE XXI

The high contracting parties agree that provision shall be made through the instrumentality of the League to secure and maintain freedom of transit and equitable treatment for the commerce of all states members of the League, having in mind, among other things, special arrangements with regard to the necessities of the regions devastated during the war of 1914-1918.

ARTICLE XXII

The high contracting parties agree to place under the control of the League all international bureaus already established by general treaties, if the parties to such treaties consent. Furthermore, they agree that all such international bureaus to be constituted in future shall be placed under control of the League.

ARTICLE XXIII

The high contracting parties agree that every treaty or international engagement entered into hereafter by any state member of the League shall be forthwith registered with the secretary general and as soon as possible published by him, and that no such treaty or international engagement shall be binding until so registered.

ARTICLE XXIV

It shall be the right of the body of delegates from time to time to advise the reconsideration by states members of the League of treaties which have become inapplicable and of international conditions of which the continuance may endanger the peace of the world.

ARTICLE XXV

The high contracting parties severally agree that the present covenant is accepted as abrogating all obligations *inter se* which are inconsistent with the terms thereof, and solemnly engage that they will not hereafter enter into any engagements inconsistent with the terms thereof. In case any of the powers signatory hereto or subsequently admitted to the League shall, before becoming a party to this covenant, have undertaken any obligations which are inconsistent with the terms of this covenant, it shall be the duty of such power to take immediate steps to procure its release from such obligations.

ARTICLE XXVI

Amendments to this covenant will take effect when ratified by the states whose representatives compose the Executive Council and by three-fourths of the states whose representatives compose the body of delegates.

MEMBERS OF DRAFTING COMMISSION.—The delegates of the Great Powers to draft the plan for the League were as follows: For the United States—President Wilson and Col. Edward M. House. For Great Britain—Lord Robert Cecil and Gen. Smuts. For France—Léon Bourgeois and Ferdinand Larnaude, Dean of the Faculty of Law of the University of Paris. For Italy—Premier Orlando and Viterio Scialoia. For Japan—Viscount Chinda and K. Ochiai.

The other nations represented were Belgium, Brazil, China, Czecho-slovakia, Greece, Poland, Portugal, Rumania, and Serbia.

OBSTACLES MET IN PREPARING LEAGUE PLAN.—Aside from the wide-spread skepticism regarding the practicability of a League of Nations, the

commission engaged in preparing the constitution of the League faced many difficulties of detail, chief of which were: (1) the relative representation and voting strength of the great and the small powers in the legislative body and the Executive Council; (2) the fate of former German colonies; (3) provision of military force.

The first difficulty was adjusted as indicated in the final draft of the constitution, subject of course to the later action of the Peace Conference.

The question of colonial claims was first simplified by excluding from consideration all territorial disputes within the European continent. It was then proposed that all former German colonies should be internationalized, and governed by designated nations acting as mandatories for the League. This proposal, advanced by President Wilson, had the effect of superseding previous agreements made among the Allied Powers, in particular the secret agreements securing to Japan control of Kiao-chau and the Marshall and Caroline Islands, which Japan has declared it is her intention to retain. Premier Hughes, of Australia, also insisted that the former German colonies north of Australia should, for reasons of strategic safety if for no other, fall completely under British control.

The third question, of military and naval forces under the direct control of the League, was raised by the French delegates, having in mind the exposed situation of France. When a resolution proposing such an international force was introduced in the committee on February 11, it received the support of only the French and Czechoslav delegates. The plain intent of the constitution, as finally adopted, however, is that the forces of the signatories shall be at the disposal of the League against a covenant-breaking state.

The majority of the members of the drafting commission had given the problem of a League of Nations most thorough study. The provisions of the constitution, while subject to modification or rejection in the Peace Conference, are therefore the product of careful thought and adjustment of divergent views.

PREMIER HUGHES' ARGUMENT AGAINST MANDATORIES.—Premier Hughes, of Australia, on February 8 sent to the American representative of Australia the following argument against the mandatory system as applied to the islands north of Australia:

"Control of the islands—absolute control—is necessary," says the message, "because mandatory control would not induce the expenditure of money on uncertain possession.

"International control is and must be indirect, and has all the defects of indirect control. Government is like all other forms of carrying on human affairs. It is a business, and the same principles apply to it as to other kinds of businesses. That business is best managed where control is in the hands of a competent man on the spot, and who knows intimately all the circumstances, and has a personal interest in its development and progress.

"Government, like that of business, rests on finance, and must fall if insufficient funds are at its disposal or if the money is spent unwisely. Who will spend money on any estate or business which he has not in actual possession, or where the tenure is uncertain, or where it is subject

to interference from men remote from, and entirely ignorant of, local conditions. Mandatory system is control by those who at best do not know. Those who do not know would in all probability control others who might be interested in thwarting or ousting mandatory in order to serve their own interests."

Mr. Hughes then reiterates the prime argument in Australia's case for absolute possession of the German islands:

"The proximity of New Guinea and the Bismarck Archipelago makes complete control of immigration and trade necessary by Australia. All that is necessary for the protection of the natives can be effected by guarantees, which Australia is prepared to give.

"The form and powers of the League of Nations are still quite uncertain, and no details of the mandatory system have yet been worked out.

"There is nothing in the Fourteen Points which presents absolute ownership of the islands.

"The mandatory is at best an expedient, applied only to cases where the interests of the inhabitants are menaced by direct control. The Australian control of New Guinea during the war, after it was wrested from Germany, has been beneficent and mild.

"The interests of Australia are also to be safeguarded, as well as those of the natives of the islands. The mandatory system would not safeguard Australia's interests unless the mandate merely gives us formally the same power over the islands as we now have over our own affairs in Australia."—*N. Y. Times*, 9/2.

MANDATES AND THE MONROE DOCTRINE.—London, Feb. 8.—The *Spectator* discussing in this week's issue the provisional decision of the Peace Conference about the former German colonies, says that it is almost impossible logically to reconcile the mandatory system with the continuance of the Monroe Doctrine, and it asks:

"What about the position of the United States in, say Hayti and San Domingo? The United States at last stepped in, very much to the advantage of the natives. But the United States was self-appointed. Under the Monroe Doctrine, she says to the old world 'hands off, no interference here.'"

CLEMENCEAU ON DANGERS TO FRANCE.—In an interview granted to a representative of the Associated Press on February 9, Premier Clemenceau spoke freely of the dangers still threatening France and the world.

"With the British Army demobilized, the American Army back home, and France isolated," he said, "there might be a danger of a reopening of the military debate by Germany which might embarrass us were it not for the assurance which President Wilson gave us in the Chamber of Deputies the other day that under the operation of the League of Nations, 'whenever France or any other free people is threatened the whole world will be ready to vindicate its liberty,' so that 'there never shall be any doubt or waiting or surmise.' This has given us great solace. And so we bid the departing American soldiers godspeed and a happy return to their peaceful firesides.

"Of course, a Society of Nations in which America and France enter must be supported profoundly by the conviction of their peoples and by a determination of each nation entering into the agreement to be willing to renounce their traditional aloofness from other peoples and willing to employ the national strength outside their own country, both in time of peace as well as under the pressure of war.

"All of our plans are based upon the splendid platform laid down by President Wilson. In perfect harmony with the principles which he has enunciated, we are striving for higher and holier idealism in the conduct of the affairs of the world. Divested of all mercenary aspirations, we

join heartily and unreservedly in the effort to make a better world and one of simple justice to all mankind."

The promise of President Wilson, referred to by M. Clemenceau, was made in a speech to the French Chamber of Deputies on February 3.

"The world," the President said, "has seen the great plot worked out, and now the people of France may rest assured that their prosperity is secure, because their homes are secure, and men everywhere not only wish her safety and prosperity, but are ready to assure her that with all the force and wealth at their command they will guarantee her security and safety."

REDUCTION OF NAVAL ARMAMENTS.—Financial considerations had much—not most—to do with bringing about the agreements reached by the representatives of the governments which have been engaged in the effort to work out a formula for the League of Nations. Take Great Britain, for example. She finds herself with a debt of $40,000,000,000, the interest on which is $2,000,000,000. Add to that another billion for annual expenses and it is seen that the British Government is obliged to raise $3,000,000,000 annually. One way of saving is providing against a race between governments in building up armaments.

It will probably surprise many people to hear that Great Britain is quite sympathetic to the proposal to reduce naval armaments; but a little reflection will bring back to memory the efforts made ever since Winston Churchill's day as First Lord of the Admiralty, seven years ago, to induce Germany to enter into a mutual arrangement for a "breathing spell" in the construction of warships. That effort failed—a circumstance which the German rulers, with their fleet not daring to take a chance against the powerful force of Great Britain, must have mulled over sorrowfully during the period of the war.

Great Britain is still only too willing to perfect the arrangement suggested to Germany, and in this she has found ready acquiescence on the part of the American representatives at the Peace Conference. The terms of the arrangement are not disclosed, because, for one reason, all the details are not yet worked out; but it is assured that a naval curtailment provision will be written into the peace treaty.

The United States, while willing to agree that naval armaments be curtailed, contends that the American Government is entitled to build as many warships as any other. This means the United States will have no restrictions placed on its building program up to the number of vessels which Great Britain, for example, will be privileged to construct. Peace agitators may work out a sliding scale of naval construction, but, whatever arrangement is made, the United States will hold that its long coast line, its remoteness from its insular possessions, and the great increase in its merchant marine, entitle it to have as large a fleet as any other nation.

But beyond these considerations, the United States will stand on the principle that the fundamental doctrine of the League of Nations is that no one nation shall be so powerful as to be able to control the seas alone.—*R. V. Oulahan in N. Y. Times, 2/2.*

BRITISH DOMINIONS TO ENTER LEAGUE.—Paris, Jan. 21 (Associated Press).—Canada, Australia, New Zealand, and to a less degree South Africa will claim the right to enter the League on the same basis as Belgium and other similar powers. In some quarters this is taken to mean that, should the occasion arise, the Dominions might oppose the Mother Country in the discussion of problems brought before the League.

Canada, Australia, and New Zealand have for several years claimed for themselves absolute independence, so far as the conduct of internal affairs was concerned, but this principle has never been formally admitted by England. The Dominions, it is said, will now ask for formal recognition of it.—*N. Y. Times, 22/1.*

CHINA SEEKS RELEASE FROM JAPANESE PLEDGES

At the Peace Conference the contention of China has been that certain special agreements entered into with Japan should be reconsidered in the general peace settlement. According to a Peking dispatch of February 10, China also rejected the Japanese proposal that her delegates should act in consonance with those of Japan and should attempt no anti-Japanese propaganda at the Conference. The grievances of China are thus stated:

Shanghai, Feb. 8 (Associated Press).—The *China Press* to-day prints an editorial attacking the policy of Japan toward China's delegation at the Peace Conference, as revealed by demands made by Yukichi Obata, Japanese Minister at Peking.

"Minister Obata's startling demand that China gag its delegates at the Peace Conference has done great service," the newspaper says. "It has posed effectively and opportunely to the whole world the issue of the Far East. The issue is whether or not this hemisphere is Japan's domain or if China is still an independent nation.

"Since August, 1914, the issue has been gathering. From Japan's ultimatum to Germany to what Minister Obata calls his friendly visit to the Wai Chiae Pu (Chinese Foreign Office), its development has been thoroughly and ruthlessly the logical sequence of events—the taking of Tsingtao, the widening of that wedge until it included a large part of Shantung, the sinister 21 demands, the Japanese contribution to the undoing of Yuan Shi-kai, the steady encroachments in Manchuria, the secret Russo-Japanese treaty, the blocking of China's entry into the war except under Tokio's aegis, the underwriting of the corrupt Northern militaristic party, the service of nefarious loans that turned over the resources of an Eldorado for a song, the setting up of a civil administration in Shantung, the arms alliance of 1918, all the other secret agreements, the Lansing-Ishii 'paramount interest' agreement, until now we have the naked question, Is China a Japanese colony?

"Can there be any other meaning of Minister Obata's demand? If China is denied the right to present its case before the Peace Conference, if its delegates can speak only by and with the consent of Japan's delegates, then it has no identity as a nation. Then it is a Japanese dependency."—*N. Y. Times*, 9/3.

In defense of Japan's policy toward China, Japanese authorities in Washington stated on February 12 that the Japanese Minister in Peking had merely suggested to the Chinese Foreign Office that, in view of the friendly relations between the two countries, China should refrain from anti-Japanese agitation and should not publish correspondence between the two governments without common consent. No treaty, it was said, had been made with China since the published treaty of May, 1915. Later correspondence between the two governments had dealt chiefly with loans, and it was the publicly-declared policy of the new government in Japan to prevent the use of loans for political pressure. (Japan in September, 1918, agreed to loan China 20,000,000 yen for railroad construction in Shantung and advanced funds, although it appears that China never ratified the agreement.)

It is stated that the Executive Council of the Peace Conference has requested that all agreements between China and Japan since the outbreak of the war be submitted to the Conference. The Lansing-Ishii Agreement of 1917, recognizing Japan's special interests in China, was

published at the time. Great Britain, France, and Italy are now reported to have entered into similar agreements.

JAPANESE FORCES IN SIBERIA.—Vladivostok, Feb. 8 (Canadian Press).—Reports from Omsk state that the Russian Government there has accepted an offer from Japan of men, money, and arms to settle the Bolshevist difficulty.

In return for the aid she is to give, the reports state, Japan will secure an iron and coal concession in the Priamur district.—*N. Y. Times*, 11/2.

WORK OF PEACE CONFERENCE COMMITTEES

During the first month of the Peace Conference, prior to President Wilson's return to the United States on February 15, interest was concentrated on the evolution of the plan for a League of Nations. Several important committees were appointed, however, to investigate problems connected with the peace treaty, and these at once began work. On January 26, Chairman Clemenceau announced the four following special commissions:

Responsibility for the War—Great Britain, Sir Gordon Hewart; France, Captain André Tardieu and Ferdinand Larnaude; Italy, Vittorio Scialoia and Deputy Raimondo.

Reparation—United States, B. M. Baruch, John W. Davis, and Vance McCormick; Great Britain, William Morris Hughes, Sir John Simon, and Baron Cunliffe; France, L. L. Klotz, L. P. Locheur, and A. F. Lebrun; Italy, Antonio Salandra and General Badoglio; Japan, Baron Makino and Baron Nobuaki.

International Labor Legislation—United States, E. N. Hurley and Samuel Gompers; Great Britain, George Nicoll Barnes and Ian Malcolm; France, M. Colliard and L. P. Locheur; Italy, Signor Des Planches and Signor Cabrini; Japan, M. Otichian and M. Oka.

Regulation of Ports, Waterways and Railroads—United States, Henry White; Great Britain, Sir John Simon; France, André Voiss and Albert Claveille; Italy, Signor Grespi and Signor de Martino; Japan, M. Yamakawa and Colonel Sato.

Secretary Lansing was made chairman of the Commission on Responsibility for the War; Mr. Gompers, of the Commission on Labor Legislation; and M. Klotz, French Minister of Finance, of the Commission on Reparation.

LABOR COMMISSION PLANS LABOR CONFERENCE.—One of the first acts of the Labor Commission of the Peace Conference was to approve a plan for an international labor organization and periodic conferences, at which each delegate should vote independently of other delegates of his nation. It was further agreed that the conference should meet at the seat of the Society of Nations, and that a permanent bureau and director should be established there.

RUSSIAN FACTIONS INVITED TO CONFER

On January 22 the Peace Conference decided upon a definite Russian policy to the extent at least of inviting all organized political groups in Russia to declare a truce of arms and send representatives to the Princes'

Islands, Sea of Marmora, where they would be met by representatives of the Associated Powers. The official communique containing the message read as follows:

"The single object the representatives of the associated powers have had in mind in their discussions of the course they should pursue with regards to Russia has been to help the Russian people, not to hinder them or to interfere in any manner with their right to settle their own affairs in their own way. They regard the Russian people as their friends, not their enemies, and are willing to help them in any way they are willing to be helped. It is clear to them that troubles and distrust of the Russian people will steadily increase, hunger and privation of every kind become more and more acute, more and more widespread, and more and more impossible to relieve, unless order is restored and normal conditions of labor, trade, and transportation once more created; and they are seeking some way in which to assist the Russian people to establish order.

"They recognize the absolute right of the Russian people to direct their own affairs without dictation or direction of any kind from outside. They do not wish to exploit or make use of Russia in any way. They recognize the revolution without reservation, and will in no way and in no circumstances aid or give countenance to any attempt at a counter revolution. It is not their wish or purpose to favor or assist any one of the organized groups now contending for the leadership and guidance of Russia as against the others. Their sole and sincere purpose is to do what they can to bring Russia peace and an opportunity to find her way out of her present troubles.

"The associated powers are now engaged in the solemn and responsible work of establishing the peace of Europe and of the world, and they are keenly alive to the fact that Europe and the world cannot be at peace if Russia is not. They recognize and accept it as generously, as unselfishly, as thoughtfully, and ungrudgingly as they would serve every other friend and ally and they are ready to render this service in the way that is most acceptable to the Russian people.

"In this spirit and with this purpose they have taken the following action:

"They invite every organized group that is now exercising or attempting to exercise political authority or military control anywhere in Siberia or within the boundaries of European Russia as they stood before the war just concluded, except in Finland, to send representatives, not exceeding three representatives for each group, to Princes' Islands, Sea of Marmora, where they will be met by representatives of the associated powers, provided, in the meantime, there is a truce of arms amongst the parties invited and that all armed forces, anywhere sent or directed against any people or territory inside the boundaries of European Russia as they stood before the war or against Finland or against any people or territory whose autonomous action is in contemplation in the 14 articles upon which the present negotiations are based, shall be meanwhile withdrawn and aggressive military action cease. These representatives are invited to confer with the representatives of the associated powers in the freest and frankest way with a view to ascertaining the wishes of all sections of the Russian people and bringing about, if possible, some understanding and agreement by which Russia may work out her own purposes and happy coöperative relations be established between her people and the other peoples of the world. A prompt reply to this invitation is requested. Every facility for the journey of the representatives, including transportation across the Black Sea, will be given by the allies and all the parties concerned are expected to give the same facilities. The representatives will be expected at the place appointed by the 15th of February, 1919."—*U. S. Official Bulletin*, 24/1.

NO CONFERENCE ON DATE SET.—At the time set for the conference, February 15, there was no prospect of a conference or of a cessation of hostilities. On February 6 the Entente Governments received from the Russian Soviet an acceptance of the invitation, with the further assurance that the Soviet Government would offer to guarantee payment of interest on the Russian national debt in the form of exports of raw materials and foreign concessions in Russia. The message ended with the statement that "the extent to which the Soviet Government is prepared to meet the Entente will depend on its military position in relation to that of the Entente Governments, and it must be emphasized that its position improves every day."

On February 12 it was announced that the Ukrainian, Esthonian and Crimean Governments and also that of General Denikine would send delegates. The Omsk Government, however, steadily refused to participate in parleys with the Reds; and on February 18 it was announced that Trotzsky and Lenine were disagreed on the wisdom of acceptance.

William Allen White and Prof. George Davis Herron, an American socialist, were appointed to represent the United States at the conference.

ITALY AND THE JUGOSLAVS

On February 18 the Italian delegation to the Peace Conference in an official note informed the secretary of the Conference that Italy could not accept the proposal for the arbitration of Italian and Jugoslav claims in Dalmatia, as urged by the Jugoslavs. The Italian position, as stated, was that all territorial claims were being submitted to the Peace Conference, and that no recourse should be had to any exceptional procedure. (It was announced on February 12 that the Jugoslav delegation had proposed that President Wilson act as arbitrator of the rival Adriatic claims.)

Italy's claims on the eastern coast of the Adriatic rest upon the secret treaty of London made at the time when she entered the war, and in accepting which Italy declares she receded considerably from the claims which she originally made as the price of her support. This agreement she now asserts should be carried out, in spite of the fact that, in a later agreement made last year at Rome between Italy and the Jugoslavs, Italy herself promised considerable concessions to the Jugoslavs for the sake of their support in the war.

JUGOSLAV STATE RECOGNIZED.—Paris, Feb. 7.—Secretary of State Lansing, in a formal statement issued to-day, announced that the government of the United States welcomed the union of the Serbian, Croatian, and Slovenian peoples. The statement reads:

"On May 29, 1918, the government of the United States expressed its sympathy for the nationalistic aspirations of the Jugoslav races, and on June 28 declared that all branches of the Slav race should be completely freed from German and Austrian rule. After having achieved their freedom from foreign oppression, the Jugoslavs, formerly under Austro-Hungarian rule, on various occasions expressed the desire to unite with the Kingdom of Serbia. The Serbian Government, on its part, has publicly and officially accepted the union of the Serbian, Croatian, and Slovenian peoples.

"The government of the United States, therefore, welcomes the union, while recognizing that the final settlement of territorial frontiers must be left to the Peace Conference for adjudication according to the desires of the peoples concerned."—*N. Y. Times*, 8/2.

GREAT BRITAIN

IRELAND DECLARED A REPUBLIC.—In the Parliament of Sinn-Feiners held at the Mansion House in Dublin on January 21, a Declaration of Independence was read and Ireland declared a republic. On the following day a temporary premier and four ministers were elected, and three delegates were chosen to attend the Peace Conference. The attitude of the British press toward these activities is reflected in this extract from the *London Daily Telegraph:*

"Ireland has enjoyed special privileges during the war which are not to her honor, but to her shame. It is known to all the world that she is now prosperous as never before in her history, and that she can secure a generous measure of self-government as soon as the three southern provinces relinquish the vain hope of triumphing over the Protestants and Unionists of Ulster. If the Sinn-Feiners insist on crying for the impossible, why, then, cry they must; but if they stretch out violent hands to grasp what is forbidden by the unyielding conditions of British security, they will have themselves and their false leaders to blame for what may follow."—*Literary Digest*, 8/2.

BRITISH RESTRICT IMPORTS.—Great Britain has issued an order, effective March 1, restricting import into Great Britain of a long list of goods, consisting chiefly of machinery, tools, and manufactured articles of all kinds. Imports of raw materials are not further restricted. The stated purpose of the measure is "to bring her own manufactures to a state of stability approaching that of pre-war days."

PORTUGAL

At the close of January an anti-republican revolt broke out in Oporto and Northern Portugal and attained some success, though according to later reports the Republican Government was moving troops into the North. A provisional government favoring the return of Manuel II was established at Oporto.

ARMISTICE RENEWED

On February 16 the German commissioners signed a renewal of the armistice. The renewed armistice is of indeterminate continuation and may be abrogated on three days' notice. The blockade of Germany is to continue, though it may be noted that export of raw materials from Germany in Scandinavian ships has been permitted since December.

The renewed armistice is understood to forbid hostilities with Poland and to establish a provisional German-Polish frontier. This, while it permits Germany to retain all of Silesia, gives to Poland agricultural districts in the province of Posen on a line roughly corresponding with the ethnic and lingual frontier.

London, Feb. 18 (British Wireless Service).—The final armistice conditions which the Supreme Council is considering will be made public before the end of the month, according to various newspapers, and they will include among the naval conditions the demolition of the forts on Heligoland and the Kiel Canal, the surrender for purposes of destruction of the German warships now interned, and the opening of the Kiel Canal for commercial use. It is stated that Germany will be left with a fleet large enough for defensive purposes.—*N. Y. Times*, 19/2.

GERMANY

EBERT ELECTED PRESIDENT.—The German National or Constituent Assembly opened at Weimar on February 6, with 397 members present. According to full election returns, the representation of parties in the Assembly was as follows: 163 Social Democrats, 88 Centrists, 75 German Democrats, 92 of the German National Peoples' Party, 22 Independent Socialists, 21 of the German Peoples' Party, and 10 scattering.

On February 10 a provisional constitution was adopted making Germany a federal republic, and Friederich Ebert, acting Chancellor, was elected first President. In his speech of acceptance Herr Ebert declared the armistice terms harsh and "ruthless," and welcomed the union with German-Austria.

TOTAL GERMAN DEBT.—Weimar, Feb. 15.—In an address before the German National Assembly, Dr. Schiffer, Minister of Finance, said that he saw the necessity for credits of 25,300,000,000 marks being requested.

Of this amount, the Minister said, 300,000,000 marks would be used for building houses.

He added that the total credits and loans aggregated more than 140,000,000,000 marks, not including 6,000,000,000 marks in Treasury notes. The bank bills in circulation, Dr. Schiffer said, amounted to 43,500,000,000 marks.

Germany's war debt of $35,000,000,000, in addition to $1,500,000,000 of treasury notes, amounts to about two-fifths of the national wealth of the old empire, as that wealth has been estimated in Washington.—*N. Y. Times*, 19/2.

POLAND

The Supreme Council of the Peace Conference on January 22 decided to send at once to Poland a mission composed of two delegates, one civil and one military, of the United States, Great Britain, France, and Italy, the object of the mission being to examine the situation in Poland and on the Polish frontiers.

The Provisional Polish Government was on January 29 given complete recognition by the United States, conveyed in a telegram from Secretary Lansing to Premier Paderewski.

In the February elections in Poland for delegates to the Constituent Assembly, the list headed by Premier Paderewski received about 50 per cent of the total vote, 15 per cent going to the Polish Socialist Party, and the remainder to Jewish candidates.

REVIEW OF BOOKS
ON
SUBJECTS OF PROFESSIONAL INTEREST

"Practical Aviation for Military Airmen." By Major J. Andrew White. (Published by Wireless Press, Inc., New York City.)

The first feature of this book that impresses the reader is its decidedly unconventional typographical arrangement. The author conducted classes at an aviation ground school at the beginning of the war, and an attempt is made to present the subject of military aviation as taught in the classroom. The illustrations are chosen from diagrams and lantern slides used and the explanatory text is on the same page as each picture or opposite to it.

The text of the book consists of a series of condensed statements, the relative importance of which is indicated by the size and character of type used. As might be imagined, the appearance of the text is somewhat unusual; in come cases four or more different sizes of type being used on one page. As each statement is complete in itself, reading the book is made rather difficult. The arrangement, however, has certain advantages, and due credit should be given to the author for his initiative in leaving well-worn paths.

At the beginning of each chapter there is a "Chapter Analysis" listing the titles of each section, and at the end there is a "Review Quiz" of 20 questions on the material of the chapter.

There are 15 chapters and an appendix. Three chapters are devoted to the theory of flight and design, one each to materials and rigging, four to the power plant (treated more thoroughly than in most general text-books), one to equipment, and the remaining five to operation.

In regard to the illustrations, the diagrams are very informing and the photographs quite worthless. Most of the latter are from the Committee on Public Information and show groups of student mechanics posed in various picturesque attitudes around obsolete aeroplanes and motors. A prize example, on page 70, is labeled "Student Aviators of the Signal Corps Closely Examining the Assembly of the Carburetor of an Aviation Engine." Here the motor is fairly successfully hidden from view by 11 stalwart young men gazing intently at the "assembly of the carburetor." There are also a number of reproductions of the paintings of Lieutenant Farré, but out of place in a book of this character.

A few of the statements made are not in accord with the facts. Among these is a remark on page 85 that the Anzani engine is of the rotary type; whereas, of course, it is a stationary radial motor. On page 98, the Caproni triplane is said to have twin 12-cylinder motors; in reality, it has three motors of six cylinders each.

The appendix consists of a glossary of aeronautical terms based on that issued by the National Advisory Committee for Aeronautics. Following each word is given the supposed French equivalent and phonetic pronunciation. I say "supposed" advisedly, as there are some glaring errors, although the list is stated to have been checked by French aviators. Among the worst mistakes is the translation of "axes" as "essieux," the French for "axles." The equivalent for "seaplane" is given as "hydroplane" instead of "hydroaéroplane" or "hydravion." There are numerous cases of misspelling, "empennage," for instance, being consistently rendered as "epannage." Notwithstanding these and similar errors, however, the book should be of assistance to student aviators for whom it has been expressly written.

J. J. I.

"Elementary Steam Engineering." By C. M. Reed. Price $3.00, postpaid. (Published by U. S. Naval Institute.)

The author has assembled in one comparatively small volume a large amount of really valuable data and information which should introduce and carry the student well into that awesome and mysterious subject, thermodynamics. Primarily intended to serve as a text-book for the instruction of midshipmen of the U. S. Naval Academy, it was developed largely with the author's personal knowledge of the conditions existing at that institution, particularly as regards the short time available for any one subject and the amount of ground-work which the student has in preparation for such a subject.

The author availed himself of the very best and most creditable authorities. A few of the subjects have been prepared from information obtained from authorities who are not perhaps so widely known to the engineering profession at large. Such as these are the subjects of flow of gas through nozzles, friction in nozzles and feed-water heater design. These methods may appear new, but the engineers responsible for them are able and thorough and hence the methods should find favor at once.

In the first chapter the author adopts the orthodox beginning of similar text-books, devoting an entire chapter to an explanation and discussion of "Energy, Work, and Power." In this is included a complete discussion of the elementary work diagram. The second chapter is a very pleasing one, and should be of considerable value to the student. "Formation and Properties of Steam" furnishes the subject and it is very well handled.

After this the author chose to introduce a discussion of "Gases" in general. Of special note in this chapter is the presentation of the gas constant and the constant "358" used in connection with gas volumes and densities.

Then a return is made to steam engineering by a chapter entitled "Entropy and the Entropy Diagram." This is well handled, but is not new, the author following the conventional methods of the well-known writers on thermo-dynamics. It should certainly serve to better prepare the student for his study of marine turbines. In one chapter the author endeavors to present "Steam Engine and Other Cycles" and succeeds very well. For the purpose of the book much of this might have been omitted, but

it is just as well that the problem has been stated in a logical and straightforward manner. The relation between the actual indicator card, the *PV* diagram, and the temperature-entropy diagram will be of value.

The chapter on "Flow of Steam and Air" will aid greatly in a better understanding of the action of steam in turbine nozzles. The explanation of "reheat of the steam due to friction in the nozzle" is especially pleasing and is sure to be of value when used in conjunction with the student's other text-books. "Heat Transmission" is well presented. As stated before, the methods may be new to the engineering profession at large, but should certainly meet with favor. Much is to be learned from this chapter.

The final chapter is devoted to "Combustion." The method of presentation is novel and certainly compact. The author deserves no little credit for thus presenting Dr. Lucke's lectures. It is possible that in some cases lack of detail will confuse the student, but this should be very easily remedied in the classroom. Of special note to engineers is the very last paragraph of the book in which the author makes a strong bid for the standardization of boiler tests. This is a commendable step.

The book is replete with problems, each chapter having a generous share. These should prove to be of great value. It is to be regretted that the answers have not been appended. The charts and tables both in the appendix and throughout the book are authoritative and of the best. This is a good feature.

The author deserves much credit for the manner in which he has, in a very short time, assembled a book worthy of much good-will and which, it is believed, must be a help to any student of steam engineering.

H. B. D.

"Seamanship." By Eugene Doane. Price, $1.25. (Published by the Rudder Publishing Co.)

To those who look upon seamanship as something of a science and an art, the title of this small volume would appear a misnomer. The author takes a young man aboard a typical cargo steamer and describes in simple terms the operation of loading and departure with the usual incidents of a voyage; all as viewed from the standpoint of a newly caught rookie. The title page states that the book gives all that is essential for a young man entering the merchant marine or navy, which appears to be a somewhat exaggerated claim. Certainly, a man entering the navy will find much more interesting information in the "Recruits' Handy Book"; and indeed the larger part of the present work relates exclusively to the merchant marine. Nevertheless the subject-matter is treated in a very clear and readable manner, and there is good reason to hope that this book may be useful in familiarizing young men with the elements of sea life in the merchant service and in stimulating them to advancement in the mariner's calling.

W. C. J. S.

"World War Issues and Ideals: Readings in Contemporary History and Literature." Edited by M. E. Speare and W. B. Norris, English Department, U. S. Naval Academy. Price, $1.40. 461 pages. (Ginn and Company.)

In this book the editors have achieved their purpose of culling from a vast mass of materials—American, British, and Continental—what may be regarded as a fairly representative collection of war literature. Furthermore, by their system of grouping they have put what must have threatened to be *disjecta membra* into a logical organization.

The first division of essays deals with *War Issues*, and includes among others President Wilson's challenge of April 2, 1917, and Premier Lloyd George's stirring and characteristic Glasgow address. The next two divisions are more descriptive and emotional, depicting the *Atmosphere of the War* and the *Spirit of the Warring Nations*, with such stories as *Dinant la Morte* by David and *Sims's Circus* by Whitaker, and sketches by Barrès, Galsworthy, Maeterlinck, and d'Annunzio. The remaining divisions take up *Democratic and Autocratic Ideals of Government*, *The New Europe and a Lasting Peace*, *Features of American Life and Character*, and *American Foreign Policy*. The chief contributors here are well known political figures and writers such as Wilson, Root, Bryce, Gilbert Murray, Lodge, and President Eliot, but there are also men of lesser note who have written well on special themes. Germany is not neglected, for we have two extracts from Treitschke, and Bernhardi on *The Decision to Make War*.

Possibly a few poems would have made the collection more complete. It is unfortunate in some respects, also, that exigencies of space have led the editors to cut somewhat freely. It must be admitted, however, that the essays thus mutilated give an effect of unusual directness and concision.

The book is eminently readable. It is probably the best of its kind for the use to which it is put at the Naval Academy, that of collateral reading in connection with historical study. And it has a permanent value as a contemporary judgment of the best that has been spoken and written during four years that like a great cliff will overshadow history for a century to come.

A. W.

NOTICE TO MEMBERS

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

G. M. RAVENSCROFT,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership. Members and associate members are liable for the payment of the annual dues until the date of the receipt of their resignation in writing. Annual dues $2.50.

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To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

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NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio,* an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, \$3.00; enlisted men, U. S. Navy, \$2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery. Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention 1896. By Lieutenant John M. Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

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APRIL 1919 No. 194

United States Naval Institute Proceedings

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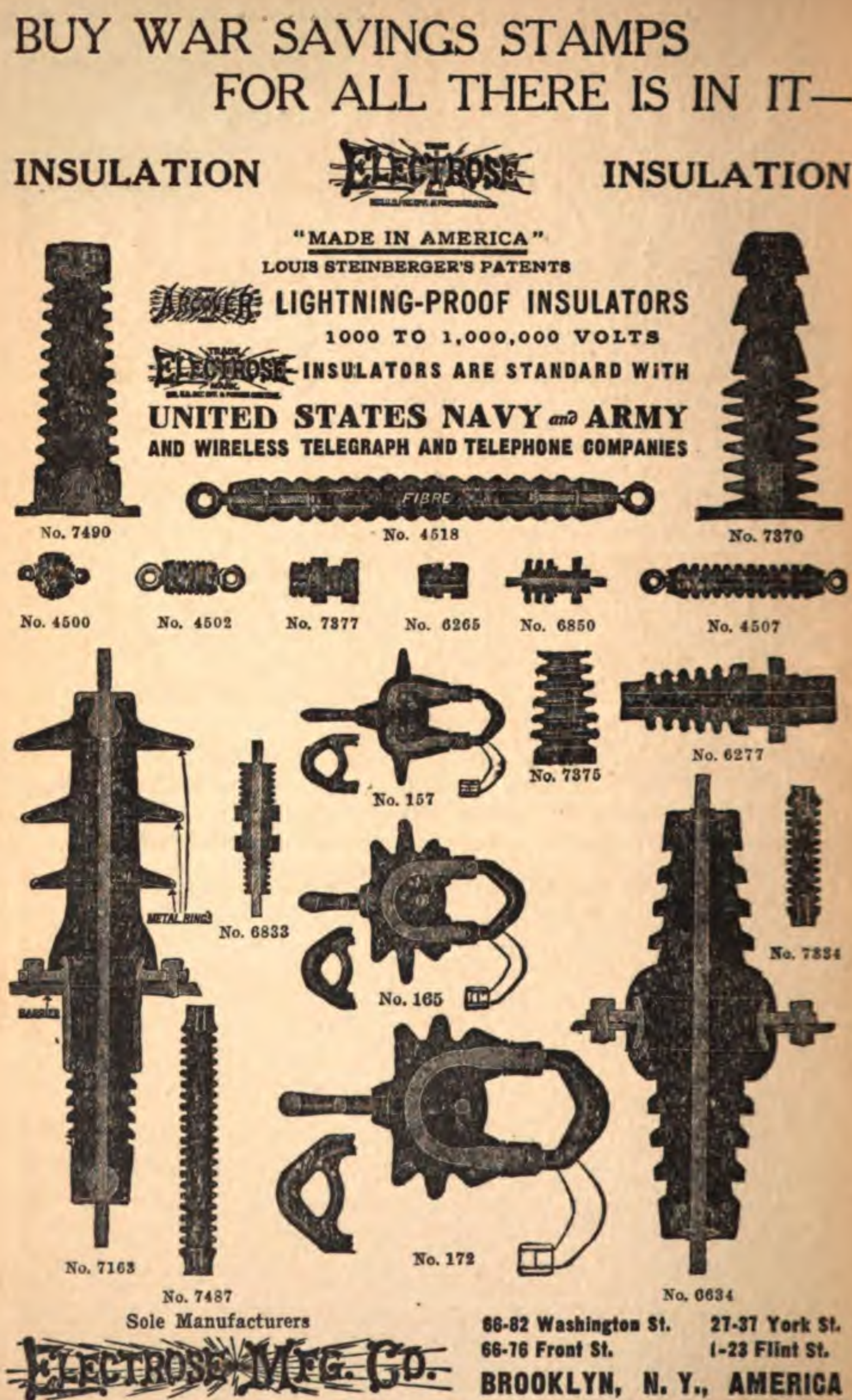

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Vol. 45, No. 4 April, 1919 Whole No. 194

United States Naval Institute
Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

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THE MEDAL OF HONOR
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UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 4 **APRIL, 1919** **Whole No. 194**

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WAR DECORATIONS

By COLONEL DION WILLIAMS, U. S. Marine Corps

A decoration in the sense here used is a badge or mark of honor to be worn upon the person as a reward for eminent or conspicuous service in battle or for honorable participation in a particular battle or campaign. Such decorations are usually bestowed by order of the sovereign or chief executive of a nation or by enactment of the parliamentary or congressional body. In many countries decorations are also bestowed for conspicuous services to the state in peace time as well as for notable achievements in the fields of art and literature. They include medals, crosses, campaign badges and ribbons and the stars and ribbons that constitute the insignia of the orders of knighthood.

War decorations may be primarily divided into several classes: the insignia of the orders of knighthood conferred for service in war, war crosses, special service medals, general service medals, long service medals, good conduct medals and badges, and medals or badges awarded for excellence in target shooting. The first class is unknown in the army and navy of the United States of America, since clause 8 of section 9 of Article I of the Constitution provides that "no title of nobility shall be granted by the United States: and no person holding any office of profit or trust under them, shall, without the consent of the Congress,

accept of any present, emolument, office, or title, of any kind whatever, from any king, prince, or foreign state."

War crosses are decorations made in the form of a cross and awarded for eminent or conspicuous service in war; special service medals are those awarded to persons by name for individual acts of gallantry or devotion to duty; general service medals are those conferred to all of the participants in a war or a particular campaign; long service medals and badges and good conduct medals and badges are issued to enlisted men for long and faithful service or for good conduct and attention to duty throughout the term of an enlistment; and those for excellence in target shooting are awarded for high percentages attained in the prescribed courses of rifle or pistol target practice.

With but very few exceptions, military medals are worn with the uniforms for which they are prescribed on the left breast of the coat between the center line and the point of the left shoulder, the medals being suspended from a holding bar by means of a ribbon of distinctive color or colors. The medals themselves are worn only with full dress uniforms, or with other uniforms when it is desired to do special honor to the occasion. With service and field uniforms, small sections of the distinctive ribbons are worn in lieu of the medals and in the same position on the coat. The exceptions referred to are noted in the descriptions of the different medals.

Where two or more decorations, medals or badges have been awarded to a person they are worn side by side suspended from one holding bar and if there are so many that they cannot be so worn in the space between the center line of the coat and the point of the shoulder the ribbons and medals are still attached to a single holding bar and overlapped so as to go in the allotted space.

The order in which the various decorations shall be arranged is prescribed in the official regulations of the army and navy. The position of honor is at the center or at the right end of the holding bar and the medals are usually arranged according to the dates of the events for which they were awarded.

The sections of the distinctive ribbons of decorations worn with service and field uniforms are arranged upon a holding bar in the same order as that prescribed for the medals, but they are never overlapped. In case there are so many ribbons that a single

bar will not accommodate them an additional bar is used, to be worn below the first bar and parallel to it.

Button rosettes made of silk of the colors of the distinctive ribbons are authorized for wear in the left lapel of the civilian coat, but only one such rosette should be worn at a time.

It is interesting to trace the origin and development of these decorations which have come to form such an important part of the uniforms of soldiers and sailors throughout the world, and which are very highly prized by the recipients as the outward and visible sign of the faithful service or of the deeds of gallantry which they commemorate.

Medals are pieces of metal struck from dies after the manner of coins for the purpose of commemorating some historical event or as rewards for service to the state in peace or war. They usually bear a design appropriate to the occasion which they commemorate, combined with inscriptions and dates of an explanatory nature or mottoes applicable to the particular deed or event.

The Greeks and Romans used medals as rewards or prizes in athletic contests and also to commemorate notable events, such as the accession of a sovereign or a great victory in war; but there is nothing extant to show that these medals were intended to be worn as a part of the uniform or dress of individuals.

The first use of medals as military decorations of which any historical record is found was by the Chinese about 60 A. D., when the Emperor Liu Siu of the Han dynasty caused medals to be made and issued to certain of his military commanders as rewards for valorous acts in battle. These medals were probably worn suspended from a cord or ribbon around the neck, as they were pierced near the upper edge, and old pictures show warriors wearing something of this nature.

It was not until many centuries later, however, that the custom of wearing medals as personal decorations became the fashion in the western world. During the reign of Henry VIII of England, 1509-1547, medals were worn as decorations by members of the nobility, but there is nothing to show that any of them were conferred by the state or sovereign as strictly military rewards for valiant service. The first medal so issued of which there is any authentic record was the so-called "Ark and Flood" medal conferred by Queen Elizabeth in 1588 as a reward for war service in the English Navy and Army. This is a silver medal bear-

ing on the obverse the effigy of the queen surrounded by the inscription, " Elizabeth D. G. Angliae F. ET HI. REG.," and on the reverse a scene representing the ark floating on the waves in the rays of the sun, surrounded by the words, " SAEVAS TRANQUILLA PER VINDAS."

A little later, in 1630, Gustavus Adolphus, " The Whirlwind of the North," conferred a military medal upon certain of his officers and men of the victorious Army of Sweden which, guided by his superb military genius, swept over Europe and founded a new school of military tactics. Other nations of Europe followed the custom of conferring medals for war service until it became universal.

In many of these medals the effigy of the sovereign was used as the principal motif for the design shown on the obverse and we find this custom still prevailing even in republics, as evidenced by the head of Lincoln upon the U. S. Army Civil War medals.

During the 330 years since the issue of the " Ark and Flood " medal by Queen Elizabeth the British Government has conferred upon her soldiers and sailors some 200 decorations to commemorate victories on sea and land or as rewards for individual acts of heroism in battle in her many wars, great and small. Following this lead other nations have conferred many such decorations, but none carried the custom to so great an extent as Great Britain.

The first medal conferred by the government of the United States was authorized by a resolution of Congress on March 25, 1776, when the news reached the seat of government at Philadelphia that the British had evacuated Boston on March 17, 1776. The resolution provided that the thanks of Congress be presented to General George Washington, commander-in-chief of the Continental Army, with a gold medal to commemorate the event. The obverse of the medal bore the effigy of Washington surrounded by the inscription, in Latin, " The American Congress to George Washington, the Commander-in-Chief of the Army and the Assertor of Freedom," and the reverse bore a design depicting the British troops embarking in their ships and the American troops entering the town from the landward side, surrounded by the legend, " The enemy for the first time put to flight."

The next medal authorized by Congress was a gold one, presented to Captain John Paul Jones with the thanks of Congress

after the great sea fighter in the U. S. S. *Bonhomme Richard* had fought his famous battle with H. M. S. *Serapis,* September 23, 1779, as a result of which the *Bonhomme Richard* sank and the victorious American captain and his crew transferred to the *Serapis* and took her into a French port. It was during this battle that the British captain, Pearson, of the *Serapis* with his ship lying alongside of the *Bonhomme Richard,* noting that the latter ship was on fire and that her gunfire had greatly diminished, called upon the American ship to surrender. With characteristic courage and tenacity Captain John Paul Jones shouted back, "I have not yet begun to fight!" This reply encouraged the crew of the *Richard* to redouble their efforts and resulted in victory for them even with the loss of their own ship.

Thus was born one of the three rallying cries of the American Navy, the other two being the words of Captain Lawrence of the U. S. S. *Chesapeake,* who during the battle with H. M. S. *Shannon* on June 1, 1813, was mortally wounded and while being :arried below decks cried out to his men, "Don't give up the ship!" and the order of Admiral Farragut at the Battle of Mobile, August 5, 1864, "Damn the torpedoes, go ahead!" given when he captain of his flagship, the *Hartford,* had reported to him that torpedo had exploded in the channel ahead of the fleet.

During the War of 1812 a number of gold medals were struck n accordance with acts or resolutions of Congress, to be preented to the commanders of the American ships in the naval ictories that marked the few bright spots in the history of that rar. Among the victors so rewarded and the battles commemoated were Commodore Perry, Battle of Lake Erie, September 10, 813; Captain James Lawrence, U. S. S. *Hornet* and H. M. S. *'eacock,* resulting in the capture of the latter ship, February 24, 813; Captain Lewis Warrington, U. S. S. *Peacock* and H. M. S. *pervier,* April 20, 1814, this being the same *Peacock* captured rom the British, the battle resulting in the capture of the *Epervier;* Captain Thomas McDonough, commanding the American quadron at the Battle of Lake Champlain, September 11, 1814; aptain Jacob Jones, U. S. S. *Wasp* and H. M. S. *Frolic,* October 2, 1812; Captain Stephen Decatur, U. S. S. *United States* and . M. S. *Macedonian,* October 25, 1812; and Captain Blakely, . S. S. *Wasp* and H. M. S. *Reindeer,* June 28, 1814.

commissioned officers and privates as have most distinguished or who may hereafter most distinguish themselves in action."

It will be noted that while the former laws on the subject authorized the award of the medal for acts performed in action during the Civil War, the act of July 16, 1862, provided for the award at any future time to enlisted men of the navy, and that the act of March 3, 1863, made a like provision for the award of the medal to officers and enlisted men of the army.

The acts of Congress referred to as applying to the naval service were embodied in section 1407 of the Revised Statutes, and in 1900 this statute was construed to mean that only enlisted men holding the specific rating, or rank, of "seaman" in the navy were eligible to receive the medal of honor. In order to effectuate the real intent of the original lawmakers, an act was passed by Congress and approved on March 3, 1901, providing, "That any enlisted man of the navy or marine corps who shall have distinguished himself in battle or displayed extraordinary heroism in the line of his profession shall, upon the recommendation of his commanding officer, approved by the flag-officer and the Secretary of the Navy, receive a gratuity and medal of honor as provided for seamen in section fourteen hundred and seven of the Revised Statutes."

Although the law of March 3, 1863, authorized the award of the medal of honor to officers of the army as well as to enlisted men, it was not until March 3, 1915, that authority was given the President to award it to officers of the navy and marine corps, that law reading as follows: "The President of the United States is hereby empowered to prepare a suitable medal of honor to be awarded to any officer of the navy, marine corps, or coast guard who shall have distinguished himself in battle or displayed extraordinary heroism in the line of his profession."

An act of Congress approved May 4, 1898, authorized the Secretary of the Navy to issue to any person in the naval service to whom a medal of honor has been awarded or may hereafter be awarded a rosette or knot to be worn in lieu of the medal and a ribbon to be worn with the medal. This resulted at first in the issue of a knot of red, white and blue ribbon to be worn by holders of the medal of honor when wearing civilian clothes, and later in the issue of a red, white and blue rosette button for the same purpose.

MEDAL OF HONOR
U. S. NAVY

MEDAL OF HONOR
U. S. ARMY

MANILA BAY MEDAL

MEDAL FOR NAVAL ENGAGE-
MENTS IN WEST INDIES, 1898

CONGRESSIONAL MEDALS

WAR WITH SPAIN

PHILIPPINE INSURRECTION

CHINA RELIEF EXPEDITION

CUBAN PACIFICATION

U. S. ARMY CAMPAIGN BADGES

SPECIAL MERITORIOUS SERVICE, WAR WITH SPAIN, U. S. NAVY

GOOD CONDUCT MEDAL
U. S. NAVY

GOOD CONDUCT MEDAL
U. S. MARINE CORPS

DISTINGUISHED SERVICE CROSS U. S. ARMY 1918

CONGRESSIONAL MEDAL
FOR PHILIPPINE SERVICE
U. S. ARMY, 1899

CERTIFICATE OF
MERIT MEDAL, U. S. ARMY

In 1876 the original ribbon worn with the army medal of honor, consisting of the 13 alternate vertical red and white stripes with the upper transverse band of blue, was replaced by a ribbon having a narrow stripe of white through the center with a narrow stripe of blue on either side and a wider stripe of red at each edge. The ribbon was arranged to be worn around the neck with the clasps and the medal suspended from it at the front and center.

The act of Congress of April 23, 1904, appropriating the necessary moneys for the maintenance of the military establishment, provided for "three thousand medals of honor to be prepared, with suitable emblematic devices, upon the design of the medal of honor heretofore issued, or upon an improved design, together with appropriate rosettes and other insignia to be worn in lieu of the medal, and to be presented by direction of the President, and in the name of Congress, to such officers, non-commissioned officers and privates as have most distinguished, or may hereafter most distinguish, themselves by their gallantry in action."

Accordingly, the design of the army medal of honor was changed and a different ribbon prescribed. This ribbon is of ight blue silk with 13 white stars at the center and is worn around he neck with the medal suspended from it at the front and cener of the coat collar opening.

The new design retains the general five-pointed star shape of he old one with the central circular medallion, but it is made of ilver heavily gold-plated and the star is superimposed upon a vreath of laurel in green enamel, while each ray of the star bears n oak leaf in green enamel. The star is suspended by means of wo gold links from a bar which is surmounted by an eagle and ing for attaching the medal to the neck ribbon. The word VALOR" appears in raised letters upon the bar. The central redallion bears the head of Minerva, the goddess of war, surounded by the inscription, "United States of America." The everse of the medal is plain, with the name, rank and regiment f the recipient and the place and date of the act for which it is warded engraved thereon, preceded by the words, "The Conress to."

As considerable confusion arose from the fact that the army ad one design of ribbon and the navy another, the joint board f the army and navy made a recommendation that the two ser-

vices use the same ribbon. This recommendation was approved by the President on March 1, 1913, and since that date the navy medal of honor has been worn suspended from a light blue ribbon with 13 white stars at the center, the ribbon being worn around the neck, thus making the ribbons identical for all services.

The rosette now authorized to be worn with civilian dress by holders of the medal of honor, whether in the army, navy or marine corps, is hexagonal in shape and is made of light blue ribbon studded with silver stars.

In the case of officers of the army who have been awarded the medal of honor the letters "M. H." are printed after their names in the official annual "Army Register." The same rule is followed in the annual "Navy Register" in the case of officers of the marine corps who have been awarded the medal of honor, but for some unexplained reason officers of the navy holding the medal are not so honored.

A summing up of the various laws relating to the award of the medal of honor leads to the conclusion that the medal is granted to officers and enlisted men of the army for distinguished service in action only, while the medal may be awarded to an officer or enlisted man of the navy or marine corps for distinguished service in battle or for extraordinary heroism in the line of his profession, the latter case being applicable either in war or peace time.

Since the first authorization of medals of honor some 2100 have been awarded to officers and enlisted men of the army and 750 to officers and enlisted men of the navy and marine corps. As it is the highest reward of the kind awarded by our government, especial efforts have been made to preserve its value as a decoration and as an incentive to personal devotion to the country and the flag by awarding it only for those acts of gallantry and extraordinary courage which stand out over and above the bravery and conscientious attention to the performance of duty which is expected and exacted of everyone who wears the uniform of the United States.

The stories of these deeds which have been rewarded by the medal of honor would fill a large volume and make fine reading for those who appreciate unfaltering courage, good judgment, quick action and unhesitating response to the call of honor and duty.

Announcements of the award of the medal and a brief statement of the reasons therefore are made to the services in the form of General Orders from the War Department or the Navy Department, depending upon whether the officer or enlisted man so cited is in the army or in the naval service.

A few examples taken from the records of the departments will serve to show the varied nature of the acts of personal bravery and conspicuous gallantry which stand out so clearly above others as to be deemed worthy of the highest reward. Without exception these acts have been of a nature not required or demanded by any specific regulation or order, but which were dictated solely by the personal call of duty—to aid a wounded comrade, to rescue the drowning, or with quick perception to perform some signal act of bravery which might lead to victory or save a well-nigh lost cause—without regard to personal life or safety.

In many cases where a gallant act of personal bravery has resulted in the death of the officer or enlisted man performing the act no medal of honor has been awarded, but the effort is not lost, the incentive is left to the living comrades, who can sadly but proudly say, "Greater love hath no man than this, that a man lay down his life for his friends."

The records of the War Department give in concise official language the accounts of the deeds for which the medal of honor has been awarded to officers and enlisted men of the U. S. Army. From these brief accounts it is not difficult to form a mental picture of the bullet-swept and shell-torn fields of battle of the Civil War, in the Indian campaigns on the lonely western plains, in the tropical islands of the Philippines, or along the muddy banks of the Pei-Ho in far-off China.

In each of the following instances, taken from these records, the medal of honor was awarded:

Private James Kephart, 13th U. S. Infantry, for most distinguished gallantry in action at Vicksburg, Mississippi, May 19, 1863, in voluntarily and at the risk of his life, under the severe fire of the enemy, aiding and assisting to the rear an officer who had been severely wounded and left upon the field of battle.

Second Lieutenant R. G. Carter, 4th U. S. Cavalry, for most distinguished gallantry in action with the Indians on the Brazos River, Texas, October 10, 1871, in holding the left of the line with a few men during the charge of a large body of Indians

after the right of the line had retreated, and, by delivering a very rapid fire, checking the enemy until reenforcements could come to the rescue.

Acting Assistant Surgeon J. O. Skinner, U. S. Army, for rescuing a wounded soldier who lay under a close and heavy fire during the assault on the Modoc Indian stronghold in the Lava Beds, Oregon, January 17, 1873, after two soldiers had unsuccessfully attempted to make the rescue and both had been wounded in doing so.

Hospital Steward W. C. Bryan, U. S. Army, for distinguished gallantry in action on the Powder River, Wyoming Territory, on March 17, 1876. He voluntarily accompanied a detachment of cavalry which was ordered to charge a village of hostile Indians and after his horse was shot and killed under him, continued to fight on foot, and, in addition, under severe fire from the Indians, he carried two wounded men to places of safety, thus preventing them from being captured by the enemy.

Captain W. E. Birkhimer, 3d U. S. Artillery, for most distinguished gallantry in action. With but 12 of his command he charged 300 of the Philippine insurrectionists at San Miguel de Mayumo, island of Luzon, on May 13, 1899, and surprised and completely routed the enemy.

Private Joseph L. Epps, 33d Infantry, U. S. Volunteers, for extraordinary gallantry in action at the defence of Vigan, Luzon, Philippine Islands, December 4, 1899. A small force of Americans garrisoning the town of Vigan were attacked during the night by a large force of the enemy and after a gallant fight in the dark the enemy was routed, but with considerable loss to the defenders. Private Epps discovered a party of insurgents within a walled enclosure and climbing to the top of the wall covered them with his gun and forced them to surrender.

Colonel Frederick Funston, 20th Kansas Volunteer Infantry, for most distinguished gallantry in action at Rio Grande de la Pampanga, Luzon, Philippine Islands, on April 27, 1899, during the Philippine insurrection. He crossed the river on a raft under fire, and by his skill and daring made it possible for the commanding general to carry the enemy's entrenched position on the north bank of the river and drive him from the important strategic position at Calumpit.

CIVIL WAR

WEST INDIES CAMPAIGN

SPANISH CAMPAIGN

PHILIPPINE CAMPAIGN

U. S. NAVY CAMPAIGN BADGES

CIVIL WAR

INDIAN WARS

CUBAN OCCUPATION

MEXICAN CAMPAIGN

U. S. ARMY CAMPAIGN BADGES

Private Louis Gedeon, 19th U. S. Infantry, for most distinguished gallantry in action at Mount Amia, Cebu, Philippine Islands, February 4, 1900. His captain fell mortally wounded, and Gedeon, single-handed and alone, defended him against the vicious attacks of an overwhelming force of the enemy until assistance arrived.

Captain Louis B. Lawton, 9th U. S. Infantry, for most distinguished gallantry in the battle of Tientsin, China, during the Boxer Rebellion, July 13, 1900. Although wounded three separate times in doing so he carried messages and guided reenforcements across a wide and fire-swept field.

Sergeant Alexander M. Quinn, 13th U. S. Infantry, and Sergeant Andrew J. Cummins and Privates Alfred Poland, James J. Nash, Charles P. Cantrell and William Keller, 10th U. S. Infantry, for distinguished bravery in the battle of Santiago, Cuba, July 1, 1898, in rescuing wounded men from in front of the lines under heavy fire from the enemy.

Captain Andre W. Brewster, 9th U. S. Infantry, for conspicuous gallantry during the battle of Tientsin, China, July 13, 1900. One of his men was twice wounded and fell into a pond of water about eight feet deep and was helpless and drowning when Captain Brewster, fully accoutered, jumped into the water and saved him.

First Lieutenant Charles E. Kilbourne, U. S. Volunteer Signal Corps, at Paco Bridge, Philippine Islands, on February 5, 1899, within a range of 250 yards of the enemy, and in the face of a rapid fire, climbed a telegraph pole in full view of the enemy and coolly and carefully repaired a broken telegraph wire, thereby reestablishing telegraph communication between headquarters and the front lines.

Major Paul F. Straub, Surgeon of the 36th U. S. Volunteer Infantry, at Alos, Philippine Islands, December 21, 1899, voluntarily exposed himself to a hot fire from the enemy in repelling with pistol fire an insurgent attack, and, at great risk to his own life, went under fire to the rescue of a wounded fellow officer and carried him to a place of safety.

Assistant Surgeon James Robb Church, 1st U. S. Volunteer Cavalry, better known as the "Rough Riders," for conspicuous gallantry at Las Guasimas, Cuba, June 24, 1898. In addition to performing gallantly the duties pertaining to his position he vol-

untarily and unaided carried several seriously wounded men from the firing-line to a position of safety in the rear, in each instance being subjected to a very heavy fire from the enemy.

Private Cornelius J. Leahy, 36th U. S. Volunteer Infantry, for most distinguished gallantry in action at Porac, Luzon, Philippine Islands, September 3, 1899. Leahy with the assistance of one comrade carried from the field of action the bodies of two comrades, one killed and one severely wounded, defending them from the attacks of the enemy and driving off a much superior force of insurgents. The order also briefly notes that Private Leahy was killed in action December 1, 1900, at Pilar, Philippine Islands.

Captain Hugh J. McGrath, 4th U. S. Cavalry, for most distinguished gallantry at Calamba, Luzon, Philippine Islands, on July 26, 1899, in swimming the San Juan River in the face of the enemy's fire and driving him from his entrenchments. The order closes with the brief notation, "Died November 7, 1899."

First Lieutenant Albert L. Mills, 1st U. S. Cavalry, and captain and assistant adjutant general of U. S. Volunteers, for distinguished gallantry in action at Santiago, Cuba, July 1, 1898, in encouraging those near him by his bravery and coolness after being shot through the head and entirely without sight.

Private John C. Wetherby, 4th U. S. Infantry, for most distinguished gallantry in action near Imus, Luzon, Philippine Islands, November 20, 1899. He had been entrusted with the duty of carrying important orders on the battlefield and while doing so was desperately wounded. Unable to stand he crawled forward on the ground and delivered his messages. He died of his wounds nine days later.

Second Lieutenant George W. Wallace, 9th U. S. Infantry, for gallantry at Tinuba, Luzon, Philippine Islands, March 4, 1900, in rescuing a brother officer who had been wounded by Filipinos from ambush and carrying him to a place of safety.

Privates William B. Trembly and Edward White, 20th Kansas Volunteer Infantry, for most distinguished gallantry at Calumpit, Luzon, Philippine Islands, April 27, 1899. These men swam across the Rio Grande de Pampanga in the face of heavy enemy fire, carrying a rope which they fastened to the trenches occupied by the enemy in order to enable others to cross the river and drive the enemy out of the trenches.

Captain Horace Porter, Ordnance Department, U. S. Army (afterwards Brevet Brigadier General), for gallantry in action ıt the battle of Chickamauga, Georgia, in rallying enough fugi-ives to hold the ground at a critical moment when the lines vere broken, under heavy fire, long enough to facilitate the scape of numerous wagon trains and batteries.

Sergeant Henry F. Schroeder, 16th U. S. Infantry, for most istinguished gallantry in action at Carig, Philippine Islands, eptember 14, 1900, in defeating with 22 men under him a force f 400 insurgents, killing 36 and wounding 90 of the enemy.

The following instances of the award of the medal of honor officers and enlisted men of the naval service—the navy and ıe marine corps—are taken from the orders of the Navy Depart-ent announcing the awards to the service:

On May 11, 1898, the torpedo-boat *Winslow,* while closely ıgaged with the enemy shore batteries at Cardenas, Cuba, was sabled by the concentrated fire of the enemy and was towed ıt of range by the revenue cutter *Hudson.* For especial gallan-y on this occasion three members of the crew of the *Winslow* re awarded medals of honor: Chief Gunner's Mate Brady for pairing the steering gear under heavy fire, Chief Machinist oney for extinguishing the fire in a boiler that had been rced by a shell, and Chief Machinist Johnson for turning off am from the engine which was wrecked by a shell exploding in cylinder. Each of these men without regard to his own ety or life performed a deed that may have saved the vessel d its crew from destruction.

On June 14, 1898, while the marines who were defending the ıporary naval shore base at Guantanamo, Cuba, were engaged h enemy infantry, firing from hastily thrown up field trenches, ecame necessary to communicate with the U. S. S. *Dolphin* in er to direct the fire of her guns. Sergeant John Quick, U. S. C., seized a signal flag and sent the signals. To do this it necessary for him to leave cover and stand on the crest of hill with his back to the enemy and clearly silhouetted against sky. This drew the fire of the enemy, whose bullets sung him and bit the dust at his feet, but he remained at his post sent the signals with coolness and precision. For this cool gallant act under fire he was awarded the medal of honor.

he U. S. flagship *New York* was steaming along the coast of

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Private Cornelius J. Leahy, 36th U. S. Volunteer Infantry, for most distinguished gallantry in action at Porac, Luzon, Philippine Islands, September 3, 1899. Leahy with the assistance of one comrade carried from the field of action the bodies of two comrades, one killed and one severely wounded, defending them from the attacks of the enemy and driving off a much superior force of insurgents. The order also briefly notes that Private Leahy was killed in action December 1, 1900, at Pilar, Philippine Islands.

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DISTINGUISHED SERVICE CROSS U. S. ARMY 1918

CONGRESSIONAL MEDAL
FOR PHILIPPINE SERVICE
U. S. ARMY, 1899

CERTIFICATE OF
MERIT MEDAL, U. S. ARMY

In 1876 the original ribbon worn with the army medal of honor, onsisting of the 13 alternate vertical red and white stripes with ie upper transverse band of blue, was replaced by a ribbon aving a narrow stripe of white through the center with a nar- ow stripe of blue on either side and a wider stripe of red at each lge. The ribbon was arranged to be worn around the neck with ie clasps and the medal suspended from it at the front and center.

The act of Congress of April 23, 1904, appropriating the ecessary moneys for the maintenance of the military establish- ent, provided for "three thousand medals of honor to be pre- red, with suitable emblematic devices, upon the design of the edal of honor heretofore issued, or upon an improved design, gether with appropriate rosettes and other insignia to be worn lieu of the medal, and to be presented by direction of the Presi- nt, and in the name of Congress, to such officers, non-com- ssioned officers and privates as have most distinguished, or ay hereafter most distinguish, themselves by their gallantry in tion."

Accordingly, the design of the army medal of honor was anged and a different ribbon prescribed. This ribbon is of ht blue silk with 13 white stars at the center and is worn around neck with the medal suspended from it at the front and cen- of the coat collar opening.

The new design retains the general five-pointed star shape of old one with the central circular medallion, but it is made of er heavily gold-plated and the star is superimposed upon a eath of laurel in green enamel, while each ray of the star bears oak leaf in green enamel. The star is suspended by means of gold links from a bar which is surmounted by an eagle and g for attaching the medal to the neck ribbon. The word 'ALOR" appears in raised letters upon the bar. The central dallion bears the head of Minerva, the goddess of war, sur- nded by the inscription, "United States of America." The erse of the medal is plain, with the name, rank and regiment the recipient and the place and date of the act for which it is rded engraved thereon, preceded by the words, "The Con- ss to."

s considerable confusion arose from the fact that the army one design of ribbon and the navy another, the joint board he army and navy made a recommendation that the two ser-

three figures on the deck of a ship of war, the central figure being an officer, the one to the left a seaman firing a rapid-fire gun, and the one to the right a marine sharpshooter with rifle in hand. Below this group upon a tablet is the name of the engagement and still below this the month and day.

The medal is suspended by the distinctive ribbon of three stripes, red, blue, red, from a bronze bar bearing the name of the ship upon which the recipient served. If bars have been awarded for additional engagements they are attached above the first bar by rings and links. The name and rank of the recipient is stamped around the edge of the medal.

On the medal Admiral Sampson is shown in the white service uniform of 1898, with the insignia of a captain in the navy upon the shoulder strap, although he was a rear admiral at the time.

MEDAL FOR MERITORIOUS SERVICE OTHER THAN IN BATTLE, 1898

The second medal authorized by the resolution of Congress of March 3, 1901, was provided to reward officers and men of the navy and marine corps who rendered particularly meritorious or hazardous service other than in battle during the war with Spain. These services included the sinking of the *Merrimac* in the entrance to the harbor of Santiago, the reconnaissance of that harbor from the land side which resulted in the definite determination of the Spanish naval forces, and the cutting of submarine telegraph cables under fire.

The decoration consists of a bronze cross pattée with a circular central medallion, upon which is a foul anchor surrounded by the words, "U. S. Naval Campaign, West Indies." The four arms of the cross bear the words and date, "Specially Meritorious Service, 1898." The reverse of the medal is plain, with the name and rank of the recipient and the event, with the date, for which awarded. The ribbon is red.

CONGRESSIONAL MEDAL FOR PHILIPPINE SERVICE

The war with Spain was closely followed by the Philippine insurrection which terminated in 1903. At the outbreak of this insurrection many officers and men of the U. S. Army who had volunteered "for the term of the war with Spain" were still in the Philippine Islands, and though they could not be legally held

CUBAN PACIFICATION

CHINA RELIEF EXPEDITION

MEXICAN CAMPAIGN


HAITIAN CAMPAIGN

U. S. NAVY CAMPAIGN BADGES

WAR WITH SPAIN

PHILIPPINE INSURRECTION

CHINA RELIEF EXPEDITION

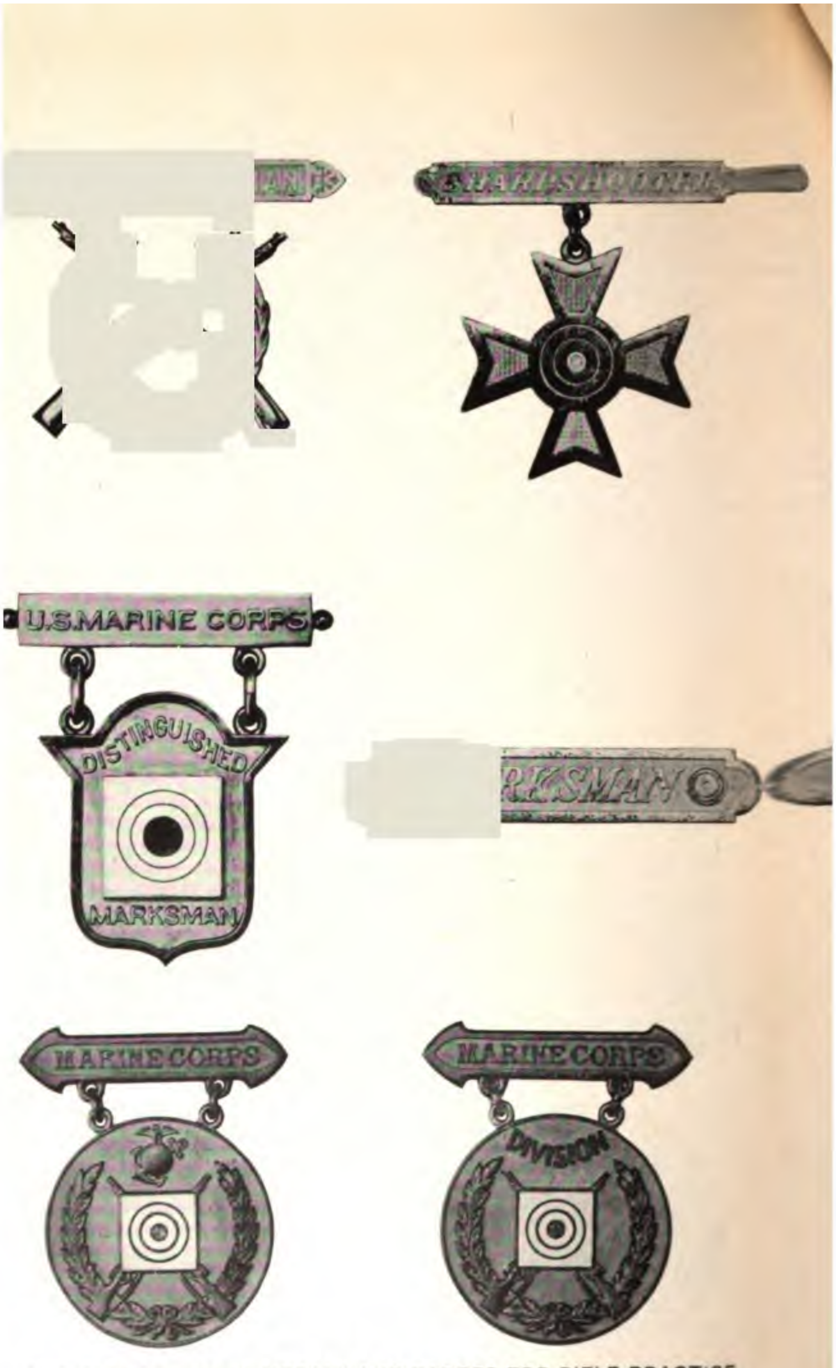
CUBAN PACIFICATION

U. S. ARMY CAMPAIGN BADGES

SPECIAL MERITORIOUS SERVICE, WAR WITH SPAIN, U. S. NAVY

OOD CONDUCT MEDAL
U. S. NAVY

GOOD CONDUCT MEDAL
U. S. MARINE CORPS



U. S. MARINE CORPS MEDALS AND BADGES FOR RIFLE PRACTICE

· service against the insurrectionists after the treaty of peace :h Spain, many thousands of them willingly so served beyond terms of their enlistment.

The faithful services of these men were recognized and rewarded an act of Congress, approved by the President on June 29, 6, which provided that a bronze medal with suitable devices presented to those officers and men "who, having volunteered enlisted under calls of the President for the war with Spain, ved beyond the term of their enlistment to help to suppress the lippine insurrection."

he obverse of this medal bears a design of a group consisting hree marching soldiers, the central one carrying the national rs and the other two carrying rifles at the shoulder, encircled he legend "Philippine Insurrection, 1899." On the reverse is the inscription, "For Patriotism, Fortitude and Loyalty," rcled by a wreath composed of a branch of pine and a branch alm.

ie distinctive ribbon has a wide band of blue through the :r with four narrow stripes on either side, colored white, red, e, blue, from the center outward.

CERTIFICATE OF MERIT BADGE, U. S. ARMY

ie U. S. Army Regulations, published by order of the Presi- prescribe that, "when any enlisted man in the army shall distinguished himself in the service, the President may grant tificate of merit to him, on the recommendation of the com- ling officer of the regiment or chief of the corps to which man belongs."

1905 a general order of the War Department announced a badge with ribbon would be issued to each officer and ed man to whom a certificate of merit has been or may here- be awarded.

is badge is of bronze and of the same size as the campaign :s, one and one-quarter inches in diameter. On the obverse Roman war eagle surrounded by the inscription," Virtutis laciae monumentum et praemium," and on the reverse side ords, "For merit," in a wreath of oak leaves with the words :ed States Army" in a semicircle above and 13 stars simi- arranged below.

The distinctive ribbon of the badge has a narrow white stripe through the center with three bands of equal width on either side of it, the colors being red, white and blue, from the center outward.

GENERAL SERVICE MEDALS

Up to 1905 no medals for general service in wars or campaigns were issued by the United States Government to its soldiers and sailors, but in that year it was decided to issue such medals to be officially known as "campaign badges," and a general order of the War Department stated that, "by authority of the President, campaign badges with ribbons will be issued as articles of uniform to officers and enlisted men in the service to commemorate services which have been or shall hereafter be rendered in campaign."

General service medals for navy and marine corps were authorized by the act of Congress of March 3, 1909, and subsequent acts, providing for "badges and ribbons, to be distributed by the Secretary of the Navy to officers and men, now or formerly, of the volunteer or regular navy and marine corps, who have participated in engagements and campaigns deemed worthy of such commemoration."

The campaign badges issued to officers and men of the army are different in design from those issued to the officers and men of the navy and marine corps for participation in the same campaigns. The distinctive ribbons for the badges were also different for the two services prior to March 1, 1913, upon which date the President approved of a recommendation of the joint board of the army and navy to make the ribbons identical for all services.

Campaign badges have accordingly been issued to the officers and men of the army, navy and marine corps who have seen honorable service in the Civil War and in all subsequent battles and campaigns up to the beginning of the present war, as follows:

Civil War Campaign Badge

The badge was issued to all who saw service in the regular or volunteer army, navy or marine corps during the Civil War between April 15, 1861, and April 9, 1865. The distinctive ribbon is very appropriately composed of two bands, blue and gray, of

width. The obverse of the army badge shows the head ncoln surrounded by the words, "With malice towards with charity for all," and on the reverse are the words, Civil War" and the dates, "1861-1865," surrounded by ath of oak and laurel.

: obverse of the navy and marine corps badge shows the is battle between the *Monitor* and the *Merrimac,* fought in aters of Hampton Roads on March 9, 1862, with the words, Civil War" above and the dates, "1861-1865," below. everse of the navy badge bears an eagle perched upon a nchor and directly below the words, "For Service," sur-:d in a circle by the legend, "United States Navy" in the half and branches of laurel and oak in the lower half. The : of the marine corps badge is the same as for the navy, that the legend reads, "United States Marine Corps."

reverse side of all of the other campaign badges for the nd marine corps is the same as that for the Civil War gn badge.

INDIAN CAMPAIGN BADGE

y officer and enlisted man of the U. S. Army who took an ›le part in any of the campaigns or battles waged against tile Indian tribes between 1865 and 1891 received one of ıdges.

campaigns so honored included the battles in Oregon, California and Nevada from 1865 to 1868; campaigns the Cheyennes, Arapahoes, Kiowas and Comanches, in Colorado and Indian Territory, 1867 to 1869; the Modoc 72-1873; against the Apaches in Arizona, 1873; against ›was, Comanches and Cheyennes, 1874-1875; against es and Sioux, 1876-1877; Nez Perces War, 1877; Ban-.r, 1878; against Northern Cheyennes, 1878-1879; against ;, 1879-1880; against the Apaches in 1885-1886; and he Sioux under the famous chief, Sitting Bull, 1890-1891. .dge is of bronze and the obverse bears a mounted Indian his war bonnet and carrying a spear, with the words, Wars" above and a buffalo skull with arrow heads on e below. The reverse side bears a trophy composed of perched on a cannon, an Indian shield, standards, rifles, rows, a Cuban machete and a Sulu kriss, with the words

" For Service " below it. Above the trophy in a semicircle are the words, " United States Army," and below it 13 stars similarly arranged.

The distinctive ribbon is Indian red with a narrow black stripe near each edge.

The reverse side of all subsequent campaign badges issued to the officers and men of the army is the same as that for the Indian campaign badge.

SPANISH CAMPAIGN BADGE

The badge was issued to all officers and enlisted men of the U. S. Army who saw active service on the high seas en route to or ashore in Cuba between May 11 and July 17, 1898, in Porto Rico between July 24 and August 13, 1898, or in the Philippine Islands between June 30 and August 16, 1898; and to all officers and men of the navy and marine corps who served honorably aboard a ship of the navy or who saw active service ashore in Cuba, Porto Rico, the Philippine Islands or Guam during the war with Spain.

The first ribbon adopted for the army badge was yellow, with a narrow stripe of red near each side edged with blue, while that for the navy badge was yellow with a narrow red stripe near each edge, very similar to the Spanish flag; but since March 1, 1913, the ribbon has been the same for both services, yellow with narrow blue stripes near each edge.

The obverse of the army badge bears a conventional castle with round towers added at each corner, one for Havana and one for Santiago de Cuba, surrounded in a circle by the legend, " War with Spain," the date " 1898," a tobacco plant and a stalk of sugar cane.

The design on the obverse side of the badge for the navy and marine corps consists of the Morro Castle at the entrance to Havana harbor, surrounded by the legend, " Spanish Campaign," and the date, " 1898."

A badge of the same design and with the same ribbon was issued to the officers and men of the navy and marine corps who participated in the naval battles and campaigns in the West Indies during the war with Spain, the legend reading, " West Indies Campaign."

Philippine Campaign Badge

'he Philippine insurrection broke out on February 4, 1899, and ; officially declared to be suppressed on July 4, 1903. The :ers and enlisted men of the army, navy and marine corps › participated in any of the campaigns or engagements during period were given the campaign badge, and it was also given hose who took part in the operations against the natives in danao during 1904-1906.

he ribbon of this badge is dark blue with a narrow stripe of near each edge. The original navy ribbon was composed of : stripes, red, yellow, red; but on March 1, 1913, the army ɔn was ordered to be used with the badge by all services.

ıe obverse of the army badge has a cocoanut tree with bal- scales on the right and a Roman lamp on the left, and the ıd, "Philippine Insurrection, 1899"; while the badge for the and marine corps has on the obverse a design of the old gate e city wall of Manila and the legend, "Philippine Campaign, -1903."

Army of Cuban Occupation Badge

ter the close of the war with Spain a Military Government nistered the affairs of Cuba pending the establishment of the blic of Cuba in accordance with the terms of the Platt ıdment. The great constructive work—sanitation, estab- ent of schools and road building—accomplished by the army cupation was commemorated by the issue of a campaign : to the officers and men who took part. The obverse is ıented with the coat of arms of the Republic of Cuba with ıtes "1898" and "1902" to the left and right of it, sur- ed by the legend, "Army of Occupation, Military Govern- of Cuba." The ribbon has a central blue stripe edged with ', with a red stripe edged with blue on either side.

The China Campaign Badge

en the Boxer Rebellion in 1900 threatened the lives of all ners sojourning in China small detachments of sailors, :s and soldiers from the American, British, French, Ger- Japanese and Russian cruisers in nearby waters were sent :ing to act as legation guards. Shortly after their arrival inese troops cut the line of communications between Peking

and the sea at Tientsin and from June 4 until August 15, 1900, the foreign legations and their nationals who had taken refuge therein were closely besieged. On the latter date the Relief Expedition, consisting of American, British, French, German, Japanese and Russian troops, totaling 12,000, entered Peking and relieved the besieged legations after capturing Tientsin and fighting through the 90 miles that lie between that port and the capital of China.

To commemorate this event the China campaign badge was issued to each officer and man of the American legation guard of marines and to the officers and men of the army and navy who took part in the Relief Expedition, either afloat or ashore.

The distinctive ribbon is of imperial Chinese yellow, edged with blue.

The obverse of the army badge bears the imperial Chinese five-toed dragon, surrounded by the legend, "China Relief Expedition, 1900-1901"; while the badge issued to the officers and men of the navy and marine corps bears a representation of the Chienmen, the main gateway to the walled city of Peking, with an imperial dragon below, surrounded by the legend, "China Relief Expedition, 1900."

THE CUBAN PACIFICATION BADGE

In October, 1906, a revolution in Cuba threatened the stability of the new republic and a U. S. naval force was sent to preserve order. Two regiments of marines were landed for the protection of foreign property and the preservation of order, but as the Cuban Government appeared to be unable to reestablish law and order throughout the island, the United States intervened, pursuant to the provisions of the Platt Amendment under which the Republic of Cuba had been established, and for three years administered the government.

A governor, appointed by the President of the United States, assisted by a force of soldiers from the army and marine corps, known as the army of Cuban pacification, conducted the government ashore, and cruisers and gunboats of the navy patrolled the harbors and waters adjacent to the island.

A campaign badge was issued to all of the officers and men of the army, navy and marine corps who participated in these operations. The distinctive ribbon has a wide band of the olive drab

U. S. Army field uniform through the center, with narrow
s of red, white and blue on either side.
: obverse of the army badge bears the coat of arms of the
ı Republic supported on either side by an American soldier,
he legend, "Cuban Pacification," above, the dates, "1906-
' below; and the obverse of the badge issued to the navy and
e corps represents Columbia presenting the olive branch to
while the dove of peace hovers above, the legend being,
an Pacification, 1908."

NICARAGUAN CAMPAIGN BADGE

1912 a revolution in Nicaragua threatened the disruption
republic and a force of sailors and marines was landed to
sh order and good government. This force inflicted a de-
defeat upon the revolutionists who opposed them and
r brought order out of chaos. A campaign badge was
to each officer and man of the navy and marine corps who
pated. The ribbon is dark red with blue stripes near each
ınd the obverse of the badge shows the smoking volcanic
f Mount Momotombo rising from Lake Managua beyond
:al forest, with the legend, "Nicaraguan Campaign, 1912."

THE MEXICAN CAMPAIGN BADGE

evolution and counter-revolutions in Mexico between 1911
17 made it necessary for the United States to maintain
patrols of army troops along the border and of cruisers
ıboats along both the Atlantic and Pacific coasts of that
, to send the punitive expedition across the Rio Grande
exico, and to conduct the naval and military operations
Vera Cruz in 1914.
mmemorate this service the badge known officially as the
ı service badge was issued to the officers and men of the
avy and marine corps who participated in these opera-
The distinctive ribbon of this badge is yellow, blue, yellow,
een edges.
bverse of the army badge is decorated with a yucca plant
, with hills in the background, and the legend, "Mexican
1911-1917"; and that of the badge for the navy and
orps shows the old castle of San Juan de Ulloa, with the
Mexican Service, 1914."

THE HAITIAN CAMPAIGN BADGE

In 1915 the little island republic of Haiti was torn with the strife of revolution to such an extent that it became necessary for the United States to intervene for the protection of the Haitians against themselves and to establish a stable government. A brigade of marines supported by a squadron of cruisers and gunboats of the navy brought peace and order to the island in a campaign that lasted from July 9 to December 6, 1915. To guard against future disorder and revolution a gendarmerie was established to police the country, this force consisting of native Haitian enlisted men, officered by officers and non-commissioned officers of the U. S. Marine Corps.

A bronze campaign badge was issued to the officers and men of the navy and marine corps taking part in the active campaigning and fighting of this expedition, the ribbon of blue with two narrow red stripes through the center being chosen because these are the colors of the uniforms and facings of the Haitian troops. The design on the obverse of the medal shows the mountains of Cape Haitien with the sea in the foreground, surrounded by the legend, "Haitian Campaign, 1915."

GOOD CONDUCT MEDALS

Any enlisted man of the navy or marine corps who has served one full enlistment of four years with marked attention to all of his duties and is recommended by his commanding officer for obedience, sobriety, industry, courage, neatness and proficiency is awarded a good conduct medal. If a man who has received a good conduct medal should be so recommended at the expiration of a subsequent term of four years service he is awarded a bar to be worn upon the ribbon of the medal.

The ribbon for the navy medal is red and that for the marine corps medal dark red with a blue stripe through the center.

The obverse of the navy medal has a vertical ship's anchor surrounded by the anchor chain and a central medallion bearing a representation of the sailing frigate *Constitution*, launched in 1797. This famous ship is still afloat and now bears the name *Old Constitution*, the name *Constitution* having been assigned to one of the new battle cruisers now building.

The obverse of the marine corps medal bears a ship's anchor and chain with a central medallion showing a marine standing at

breach of a rapid-fire gun, and a scroll carrying the motto of corps, "Semper Fidelis."
he reverse of both medals has the inscription, "Fidelity— —Obedience," in a circle, enclosing the name of the recipient, date of his first enlistment and the ship on which he served.

THE GOLD AND SILVER LIFE SAVING MEDALS

ırious acts have been passed by Congress authorizing the etary of the Treasury to bestow life saving medals upon "any ›ns who shall hereafter endanger their own lives in saving, or avoring to save, lives from perils of the sea, within the ed States, or upon an American vessel." The first of these approved by the President on June 20, 1874, authorized two es of these medals, the first class to be confined to cases of me and heroic daring and the second class to be given in not sufficiently distinguished to deserve the medal of the class.

bsequent acts prescribed that the first class medal should ıde of gold and that of the second class of silver. These life g medals are awarded to both civilians and members of the and military services and in the latter case medals and ribare worn with uniform in the same manner as the strictly lecorations.

medals, struck from coin gold or silver, are beautiful exs of the medalist's art and are highly prized as the tribute y the nation to individual courage and heroism on the sea.

THE DISTINGUISHED SERVICE CROSS

ler date of January 12, 1918, the President authorized the of two decorations and two insignia for service in the t world war, the decorations being the distinguished service ınd the distinguished service medal, and the insignia being rvice chevrons and wound chevrons.

distinguished service cross is of bronze surcharged with ıerican spread eagle, suspended by a ribbon of dark blue, arrow stripes of blue and white at each edge. The first d of these decorations which were struck had the arms of ›ss decorated with oak leaves, but in subsequent ones the were omitted and the cross made plain. The cross is

who, since the 6th of April, 1917, has distinguished or who shall hereafter distinguish himself by extraordinary heroism or by distinguished service in the line of his profession, in cases where such heroism or distinguished service is not of a character to justify the award of the medal of honor or the distinguished service medal. The cross is to be suspended from a distinctive ribbon, and a rosette or other appropriate device is to be provided to be worn in lieu of the cross.

The law also provides that any enlisted or enrolled person to whom a medal of honor, a distinguished service medal or a navy cross is awarded shall receive $2 per month additional pay for each such award; and that in case of further acts deemed worthy of the medal of honor, the distinguished service medal or the navy cross, a suitable bar or other emblem or insignia to be worn with the decoration.

WAR SERVICE CHEVRONS

By order of the President, war service chevrons are prescribed consisting of a V-shaped bar of gold braid one-quarter of an inch in width with each arm two inches long. One of these chevrons is worn by each officer and enlisted man or woman of the army for each period of six months service with the American Expeditionary Force in France, the chevrons being worn on the lower half of the left sleeve of all uniform coats, points down. A similar chevron of blue cloth is provided for similar service for a period of less than six months; and for service other than with the American Expeditionary Force in France a silver chevron is authorized for each period of six months service.

For active service in the fleet during the present war officers and enlisted men of the navy and marine corps are authorized to wear gold chevrons on the left sleeve of all uniform coats, the chevrons being similar to those prescribed for the army, except that in the navy they are worn with the points up.

WOUND CHEVRONS

The same order which authorized the war service chevrons provided for a chevron of the same description to be worn upon the lower half of the right sleeve by each officer and enlisted man who has received or may hereafter receive a wound during action with an enemy which necessitates treatment by a medical officer,

T BRITAIN—VICTORIA CROSS

GREAT BRITAIN—DISTINGUISHED SERVICE ORDER

I—ORDER OF LEOPOLD

BELGIUM—CROIX DE GUERRE

FRANCE—LEGION OF HONOR

FRANCE—MEDAILLE MILITAIRE

FRANCE—CROIX DE GUERRE

ITALY—ORDER OF ST. MA
AND ST. LAZARUS

ding disablement by gas attack. Additional chevrons are ›rized for additional wounds, but in case of two or more ıds received at the same time but one chevron is worn. nd chevrons are also issued to women serving with the army.

TARGET PRACTICE MEDALS AND BADGES

the United States services the importance of training at : firing both with small-arms and great guns has ever been n view and every effort has been exerted to reach the high- ıte of proficiency.

: officers and men firing the prescribed courses are arranged lasses according to the degree of proficiency attained, and se in the higher classes medals and badges are awarded, n the case of enlisted men, increases of pay are granted. ile not strictly war medals, these medals and badges for ence in marksmanship have received the sanction of Con- and the regulations prescribe that they be worn with uni- in the same manner as the decorations for gallantry and in battles and campaigns.

marksmanship badges for the army and the marine corps : same in design and include, for rifle firing, the expert n badge, the sharpshooter badge and the marksman badge, · pistol firing, the pistol expert badge, all of silver; the dis- hed marksman, gold medal; and gold and silver medals ›artmental and division competition matches.

marksmanship rewards for the navy include the sharp- bronze medal and the expert pistol silver bar.

›us medals and badges awarded by the National Rifle Asso- to the winners in the matches held under their cognizance authorized to be worn by officers and enlisted men of the avy and marine corps.

FOREIGN DECORATIONS

e 8 of section 9 of Article I of the Constitution of the States prohibits any person holding a position of profit or der the government from accepting a medal or decoration y foreign government without the consent of the Con- By the terms of a recent joint resolution of Congress per- is granted for any officer or enlisted man of the military forces of the United States to accept and wear any

The V. C. has never been conferred upon any one except officers and men of the British land and sea forces, including regulars, volunteers, reserves, colonial forces, auxiliaries and persons serving in some capacity with the forces. It takes precedence over all other decorations and medals and whenever it is possible to do it is personally pinned upon the breast of the recipient by the king.

The decoration consists of a bronze cross pattée suspended from a bronze bar by a link made in the shape of the letter "V," for Victoria. On the center of the obverse is a royal crown with a lion passant gardant standing upon it and a semicircular scroll surrounding it upon which is the inscription, "For Valour." Upon the reverse, which is plain, is engraved the date of the act for which the cross was awarded. The name and rank and the ship or regiment of the recipient is engraved upon the back of the bar from which it is suspended.

The ribbon is blue for the navy and red for the army, and in the very rare cases where the reward has been given for a second act deemed worthy of the V. C. a bar is attached to the ribbon.

The Military Cross is a distinctive decoration of the present war, having been established on December 31, 1914, to reward captains, lieutenants and warrant officers of the land forces for conspicuous service in the war who have been recommended for the honor by the Secretary of State for War. It is of silver and bears in the center the imperial cypher "G. R. I.," and upon each arm an imperial crown. The ribbon is white, purple, white, in stripes of equal width.

The Distinguished Service Cross was established in 1901 to reward warrant officers, midshipmen, naval cadets and clerks of the British Navy for distinguished service before the enemy, under the name of the Conspicuous Service Cross. In October, 1914, the name of the decoration was changed to the Distinguished Service Cross and it was ordered that it should be awarded to officers of the navy and marine below the rank of lieutenant commander or major, thus making it correspond to the Military Cross for the land forces.

It is a four-armed silver cross with the arms convexed, bearing upon the obverse enclosed in a circular rim the imperial cypher, "G. R. I.," surmounted by an imperial crown. The ribbon is blue, white, blue, in stripes of equal width.

.Y—ORDER OF THE CROWN

ITALY—MILITARY ORDER OF SAVOY

RDER OF KARAGEORGE

SERBIA—ORDER OF THE WHITE EAGLE

JAPAN—ORDER OF THE RISING SUN

PORTUGAL—ORDER OF ST. JAMES OF THE SWORD

RUSSIA

GERMANY—IRON CROSS

AUSTRIA—ORDER OF FRANZ JOSEPH

ARIA—ORDER OF ST. ALEXANDER

TURKEY—ORDER OF MEDJIDIE

Distinguished Conduct Medal was established in 1854 by
Victoria to reward non-commissioned officers and privates
rmy " for distinguished conduct in the field." This medal,
known as the D. C. M., is of silver suspended from an
ital scroll clasp. On the obverse is the head of the reign-
:reign and on the reverse the legend, " For distinguished
in the field." The ribbon is red, blue, red, in stripes of
idth.

Conspicuous Gallantry Medal was originally authorized
he Crimean war and again in 1874 to reward petty offi-
men of the navy and non-commissioned officers and pri-
the marines for conspicuous gallantry in action. It
nds to the Distinguished Conduct Medal for the army.
lal is of silver and bears on the obverse the head of the
sovereign and on the reverse the legend, " For conspicu-
ıntry," surrounded by a wreath and surmounted by a
The ribbon is blue, white, blue, in stripes of equal width.

ilitary Medal was sanctioned by King George V in March,
reward non-commissioned officers and men of the army
e been recommended by the commanding general in the
acts of bravery. It is a silver medal with the effigy of
on the obverse and the inscription, " For bravery in the
rrounded by a wreath surmounted by a crown, on the
The ribbon is dark blue with five narrow stripes through
r, two red and three white.

stinguished Service Medal, established in October, 1914,
'd to petty officers and men of the navy and to non-com-
l officers and privates of the marines " who show them-
the fore in action and set an example of bravery under
corresponds to the Military Medal for the army. It is
ıedal, bearing on the obverse the bust of King George V
form of an admiral and on the reverse the legend, " For
hed service," surrounded by a wreath and surmounted
vn. The ribbon is blue with two narrow white stripes
he center.

BELGIAN WAR DECORATIONS

lgian War Cross was established on October 25, 1915, as
on to reward all persons who have been mentioned in

general orders for individual acts of courage, devotion or valor during the war against Germany and her allies. The war cross is of bronze and is modelled after the French *Croix de Guerre.*

The Queen Elizabeth Medal was authorized in September, 1916, to reward those who have devoted themselves to war work, such as succoring the wounded, aiding refugees and fugitives and maintaining canteens and rest stations for the soldiers at the front. The medal is awarded in the name of the popular queen of Belgium to men and women, both Belgian and foreign, who are deemed worthy of it.

The Military Medal was instituted by royal decree on September 15, 1902, to reward " soldiers of all ranks below that of a commissioned officer who, by their conduct and service, have merited special distinction."

Italian War Decorations

Italy has established no new decorations for war service during the present war, but when she entered the war in 1915 she had four orders which might be conferred upon officers of certain classes, and had awarded numerous medals for service in past wars.

The Medal for Military Valor is awarded to officers and men of the Italian army and navy for conspicuous acts of gallantry and courage in the face of the enemy. The medal is awarded in three classes, of gold, silver or bronze, according to the class of the service. The gold medal has almost always been awarded for a deed of heroism and daring which has resulted in the death of the soldier or sailor performing the deed and it is regarded as the highest tribute to bravery which Italy can pay.

The silver and bronze medals are awarded for gallant deeds under fire, and as one medal is awarded for each act meriting the reward, it is not uncommon to see an officer or soldier with two such medals.

The ribbon of the medal is blue.

All officers and men of the Italian army who have served one year at the Austrian front are authorized to wear a ribbon of the national colors, green, white, red, in the same manner as the ribbons of medals and decorations are worn; and those who have served a year on the fronts in Macedonia and Albania are authorized to wear a red and white ribbon.

SERBIAN WAR DECORATIONS

ost highly prized war decoration of Servia is the Medal ery, established in 1885. It is made of gold for the first of silver for the second class. The gold medal of the is awarded to officers for deeds of great bravery in the he enemy and very rarely to non-commissioned officers of extreme daring and courage performed after all the :esent had been killed. The silver medal of the second warded to non-commissioned officers and privates for especial bravery in action.

verse bears the head of the great national hero of Ser- :h Obilitch, who in 1389 at the battle of Kossova de- Turks, killing their leader, the Sultan Murad, with his 1. The reverse bears the legend, " For bravery." The ›lue.

dal for Military Merit was authorized by the king in :ward officers and men of the army for meritorious peace or war. The medal is of gold for the first class, › officers, and of silver for the second class, awarded ımissioned officers and privates.

›bverse is the crown of Servia and on the reverse the 'or Military Merit." The ribbon is blue and white.

will be seen that the bits of metal and the strips of d ribbon that adorn the breast of our soldiers and not meaningless baubles chosen to satisfy a passing :h one marks some gallant deed on the bloody field of ·ind-swept sea, some duty for the country well done ars of faithful service under the flag in the ceaseless insure " that government of the people, by the people, ›le, shall not perish from the earth."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL APPROPRIATIONS

By CAPTAIN CHARLES CONARD, P. C., U. S. Navy

INTRODUCTORY

appropriation system of the Navy Department constitutes icap against the uniform advance in industrial and admine methods which has been and is being made from year to As military efficiency is of course affected by the degree ;ress made in the industrial and administrative branches, portant to remedy any defects known to exist therein.

unnecessary to say that this condition has been commented 1 time to time. Two references only will be made.

iral McGowan in his report as paymaster general for the :ar 1915, said:

ition to interfering with the proper distribution of costs, the present ted method of making appropriations entails a great volume of ary paper work and a mass of bookkeeping detail, the disad- of which are felt throughout the naval establishment.

ral Cowie in a lecture before the Naval War College, ier 3, 1915, said:

ival appropriations at the present time are very complex, and them carry identical clauses. Their consolidation would simplify ss transactions connected with purchases, permit more accurate unting, facilitate the reporting of expenditures and result in an il distribution of funds by administrative authority at the time ity for a particular expenditure becomes apparent.

avy is in the fortunate position of not having to make ses for failure to produce. A request made to Congress e us of the burden of the unsatisfactory appropriation cannot, therefore, be ascribed to weakness, but rather ngth born of overcoming difficulties.

following article, it is first shown that the navy has made ble progress in getting around the obstruction of the tion system. But we still carry the deadweight of it,

and an attempt is made to indicate how it can be removed from our path without causing any disorganization of our work.

There never was a better time than the present for settling this problem.

The financial, or fiscal, system of the Navy Department runs so smoothly and has so well withstood the strain of the present war, that few outside of those in immediate touch with the details of the problem appreciate the difficulties which have been overcome in the past, or those which still remain to be cleared up. The navy methods for obtaining and handling funds and stores are believed to be superior to those of most other departments of the government; certainly when comparison is confined to the long-established executive departments, where old traditions and inherited systems tend to complicate the routine. Some of the recently instituted departments have undoubtedly been able to start with systems untrammeled by ancient customs, and should therefore be better off in this respect than the older institutions.

In order to obtain a clear idea of the present navy methods, it will be well to describe briefly how money is obtained and handled, and then to glance back over the changes which have been introduced in late years.

To obtain funds for a coming fiscal year estimates from the bureaus, based on reports from the various yards and stations, are submitted to the Secretary, gone over carefully and forwarded to the Secretary of the Treasury for transmission to Congress. These estimates are divided under headings, called appropriations, in accordance with the purposes for which the money is desired. Each bureau has its own group of appropriations, the titles of which indicate more or less closely the ultimate objects of expenditures. However, as the result of long custom, the titles of some appropriations give only a broad indication of the nature of the proposed expenditures, and in that case there is added a somewhat detailed wording intended to specify or describe in a general way the kinds of charges which are to be met under that appropriation. It must be remembered that formerly each bureau maintained a kind of independence, not only as an administrative section of the Navy Department, but also as a managing element of the yards and stations. Consequently each bureau sought to incorporate in the appropriation bills word

› indicate its functions and to tighten its control over the rs in which it was interested. From time to time new activi- rere taken up and mentioned in succeeding appropriation while more or less obsolete details were still retained, or ated only after considerable time. Thus the main or lead- propriations of the several bureaus contain descriptive word- hich attempts to delimitate, in a certain degree, the func- of the bureaus, and which, from the manner in which this ng has been compiled, is unscientific and unsatisfactory. addition to the main appropriation of each bureau, other priations more specific in their nature are included in the n many cases the objects of expenditures mentioned in these c appropriations are also covered in general terms by the appropriations, so that often payments can be made either the bureau's main appropriation or from one or more of cific appropriations.

gress having gone over the estimates submitted, the appro- n bill is finally enacted into law. The final figures of the reached only after careful inquiry by the Congressional tees, the Secretary, bureau chiefs, and others concerned ng before these committees and explaining the needs of vice in detail. After the bill is passed and signed by the nt, it is carried to the treasury books, and the money s available for use. On the treasury books the sums ap- ted are recorded under the names of the several hundred iations mentioned in the act, and from that point on a nd debit account is maintained for each individual appro- covered by the bill. The same procedure is followed Bureau of Supplies and Accounts.

the exception of the Navy Department, for reasons to ined below, the general practice of the government when re to be drawn from the treasury, is to specify the par- ppropriation concerned for each intended payment. Thus sing officer having 20 payments to make, each under a appropriation, must procure the amounts necessary different accounts, and must keep each one of these ation accounts separate and distinct from all the rest. that he may have ample funds under other appropriation would not permit him to make payment of any one of bills until new funds were obtained from the treasury

properly " ear marked " for the purposes intended. For a long time the Navy Department carried out this involved and laborious routine in common with other departments of the government. Delays in payments were frequent, as it was necessary to secure the funds for each voucher by means of requisitions, via the Secretary of the Navy and Secretary of the Treasury, culminating in warrants on the treasury under which the money was placed to the disbursing officer's account.

A necessary modification had been made, however, in the cases of naval vessels. It is evident that ships in all parts of the world could not procure funds in the manner above described, and consequently a practice had grown up of making payments of all kinds from " Pay of the Navy " and afterwards adjusting between that and the appropriations actually concerned.

In 1878 a modification of the law was obtained as follows:

> That the Secretary of the Navy be, and he is hereby, authorized to issue his requisitions for advances to disbursing officers and agents of the navy under a " General Account of Advances " not to exceed the total appropriation for the navy, the amount so advanced to be exclusively used to pay current obligations upon proper vouchers and that " Pay of the Navy " shall hereafter be used only for its legitimate purpose, as provided by law. (20 Stat. 167.)

From then on supply officers of vessels and on foreign stations obtained funds under " General Account of Advances." The appropriations chargeable with expenditures were shown on statements accompanying " Accounts Current," and the treasury made the necessary adjustments when the accounts were received. This practice was confined, however, almost entirely to ships on foreign stations, although it became customary to place in the hands of the disbursing officers in the United States small amou under " General Account of Advances " to be used by them emergency cases. When so used, however, the disbursing offi promptly forwarded a requisition for funds under the appropr tion concerned to cover the payment in question, thus mainta ing a complete balance under each appropriation of receipts a expenditures.

In 1907 authority was obtained from the Treasury Departme to utilize the law of June 19, 1878 (quoted above), for all pa ments made by the navy. The system of withdrawing mon from the treasury under the names of the multitude of approp tions was completely discarded, and thereafter each disbur

r was, and is now, supplied with funds entirely under "Gen-
\ccount of Advances." The plan adopted for home stations
ıple and efficient. Each disbursing officer is charged with
d sum, the amount of which is based on his probable needs.
eports his expenditures periodically (daily, weekly or
ıly, according to the size of the office) and is reimbursed
the amounts actually expended, so that an even flow of
is maintained to his credit, to offset the expenditures actu-
ıade. The charges to the various appropriations are made
Bureau of Supplies and Accounts and in the Treasury
tment in accordance with the vouchers submitted by
sbursing officers, "General Account of Advances" being
:d at the same time that each appropriation is charged.
imilar method of procedure has been adopted for stores.
rly all materials were bought under the individual appro-
ns and held in store in separate lots until used. Where
:d arose to use for the purposes of one appropriation stores
had been purchased under another appropriation, it was
ıry to effect a transfer between the two appropriations con-
involving much bookkeeping and paper work. Various
ions were adopted relative to the common use of stock
had been procured in previous fiscal years, but the system
e which led to endless confusion and argument. Congress
duced to appropriate money for the establishment of a
l Supply Fund" to be used for purchasing stores for gen-
:. When these stores were used, the values were credited
'und, and corresponding charges were made to the appro-
s under which the materials were utilized. A "revolving
was thus maintained. The principle was recognized as
ɔund and efficient, but the amount of the fund, $2,700,000
ufficient. Finally the matter was settled by turning all
; of stock into the common fund (excepting certain tech-
d special articles) and establishing a section of the "Gen-
count of Advances" known as the "Naval Supply Ac-
At present stock is purchased and held under "General
of Advances, Naval Supply Account" until used, where-
e values are credited to this intermediate account, and
opriation charged.
ɔrief description has been given in order to indicate our
status and to show the improvements which we have

is found in the naval instructions of to-day, and illustrates pretty well our attitude of mind in regard to the distinctions between appropriations.

As a matter of fact, the question of which appropriation to use for a given piece of work is one that is constantly arising, and is not only a serious difficulty, but usually causes a vexatious loss of time. A recent example is as follows:

The supply officer at a navy yard having worked out, in conjunction with the Public Works Department, a plan for the installation of certain sand unloading machinery, correspondence took place, of which the following is an abstract:

(a) The public works officer states that his department has no funds available for the equipment. That it is portable equipment similar to other kinds, the property of the storehouse. Requests information as to whether supply officer concurs, as further action is dependent upon determining which bureau shall pay for the equipment.

(b) Supply officer considers the installation properly chargeable against a public works appropriation.

(c) Public works officer does not consider argument used by supply officer as sound; furthermore, as prospect of obtaining funds for project from Bureau of Yards and Docks is not bright, suggests that supply officer take such steps as are practicable towards purchasing the equipment.

(d) Commandant approves.

(e) Supply officer submits requisition under "Maintenance, Supplies and Accounts."

(f) Bureau of Ordnance returns requisition, as not chargeable to appropriation indicated. States that it appears to be chargeable to appropriation "Naval Gun Factory Tool and Machine Plants."

This correspondence consumed over two months. A perfectly conscientious effort was made by all concerned to properly locate this charge. It will be noted, however, that the problem was to determine the *source* from which the funds were to be obtained. The proper head under which to record the expenditures when made, that is, the expense classification, was not even considered. The accounting system will handle that phase of the matter with ease, no matter what appropriation supplies the funds.

The naval accounting system has recognized that an accurate statement of purposes for which money has been expended is essential, the mere record of the amount expended from each appropriation being insufficient. Each expenditure is therefore located under one of the main "titles" of the naval establishment, descriptive of the purpose for which the money was used. Thus,

ɔpropriation is dissected according to these titles. It might ght that one appropriation would naturally be expendler one title, and so on. To show how far from the truth iew is, a diagram has been drawn, in which the appropriar the fiscal year 1917 are listed and connected by lines to ous objects of expenditure, or titles. It was found imɔle to list all the appropriations, on account of the great of them, so the diagram includes only the most important name, arranged or grouped under each bureau. The of the remaining ones not named is also stated in each l all titles which pertain to these appropriations are indiconnecting lines.

elieved that the diagram gives a better idea of the interand complication of the appropriation system than could bed by pages of writing. The fact that every title, or expenditure, draws funds from a great number of apons is clearly brought out. In other words, although such a great number of different sums appropriated, the of expenditure are relatively few, and consequently it em more reasonable, if separate appropriations for parirposes are to be made, that at least but one appropriallowed for each purpose.

er, this does not really carry us to the root of the matter. to be most carefully noted in this connection is that exf sums allowed for specific work, such as items under orks," the amounts which we carry on our books as apns are in fact *merely the final approved estimates of the* ch will be needed during the ensuing fiscal year for the urposes of the naval establishment. When we solidify nates into fixed sums, as though we had plans and specior definite work ahead, we become involved in many in the practical carrying on of affairs. Especially is this r existing conditions where the terms of many of the ations" are vague and incomprehensive, and where so lapping exists as to the possible objects of expenditure. imine for a moment the regular course of procedure in the sums appropriated for the navy. As we have seen, u, at the beginning of a fiscal year, has at its disposal a appropriations to be used in carrying on the work in bureau is interested. The money must be so apporɔngst the various yards, ships etc., that each month the

expenditures must average the correct proportion of the totals available, due regard being had to the character of the demands arising. Every effort is made to avoid obligations which will result in the overexpenditure of any given appropriation. Consequently, when it is seen that the monthly demands on such an appropriation are running ahead of the allotted sums, costs which would otherwise be charged to this appropriation are located under other appropriations which, as has been explained in preceding paragraphs, are also chargeable with such expenditures. Attention is largely concentrated on keeping accurate records showing the available balances of the *sources* of funds (*i. e.*, the appropriations), rather than on clearly showing the exact objects for which sums are expended. It is true that the objects of expenditure are faithfully recorded through the cost accounting system, but their importance is diminished owing to the interest in the appropriation accounting.

The acounting instructions, in treating of this matter at some length, conclude as follows:

> Appropriation charges show the source or legal authorization for the expenditure of the various sums of money devoted to output and maintenance. Cost charges show the disposition of the money, the final resting place of values. The two classifications are independent and cannot be made identical without impairing the legality of one or the correctness and administrative value of the other. The cost of an item of output cannot be correctly determined except by taking into consideration the elements thereof contributed by numerous appropriations.

Now the bureaus concerned, being mainly interested in the charges to their appropriations, do not follow with equal attention the question of costs under the various expenditure heads, especially since those accumulated costs affect a variety of appropriations with many of which a given bureau is not concerned. A glance at the diagram gives some idea of the extent to which this diffusion of sources is carried. It does not tell the whole story, however, as it does not bring out the facts relating to individual pieces of work, or jobs. Not only is it true that several appropriations have charged to them jobs of similar nature, but also it is necessary that the cost of any single job be made up of charges from a variety of appropriations. The resulting complexity is obvious.

Imagine an industrial plant which, in additon to the usual plan of exhibiting its receipts and expenditures in all the detail necessary to give a clear and comprehensive understanding of

iess conducted, including a complete cost system, also ed to show how every element of income was distributed, ach sum received in such a way as to indicate the final n of every sum throughout the multiplication of book- letails. Such a plant might then be in position to answer 1 like this: "You have spent $10,000 for repairs to build- here did you get the money?" The answer would be: m spent for repairs to buildings was obtained thus: Wm. Smith & Co., $43.10, interest on investments $7.42, .ise account $8421, royalties account $3.02, and so on 1 list of receipts. Such a system would be well-nigh : and perfectly useless. It would, however, be closely our naval appropriation cost accounting system, where iore attention is given to following the status and distri- the *sources* of supply (the appropriations) than to the expenditure.

rove conditions the first step would be to have *all esti- mitted under the same headings as those used for the nditures themselves.* In this connection the following :rom the conference on accounting, June, 1914:

> it be possible to put into effect an entirely suitable and satis- :em until the methods and classifications used in submitting Congress and the wording of appropriation bills are corre- modified and revised so that all estimating, appropriating nstructions are harmonized and so that identical terms, classi- l meanings will exist throughout.

r, even were estimates submitted under the logical rovided by the accounting system, if these estimates oval were embodied into appropriations, as the present are, the situation would be only slightly improved. ıld still remain the fact that several distinct sources of funds have to be entered on the treasury books, and ications would exist due to the necessity of tracing : to its final disposition, as well as analyzing each ex- ead, to show whether two or more appropriations were *The real cure for our troubles is to let estimates remain id not to convert them into separate and distinct appro- all, except that the total of all estimates would make the Naval Appropriation Act.*

lvantage, in the way of strict accountability or accu- ation to Congress, gained by the present system of

many appropriations? To answer intelligently, let us examine the relations existing between the Navy Department and the Treasury Department and Congress, in regard to these appropriations.

The Treasury Department is charged with the duty of determining whether or not any given voucher covering expenditures of funds by the Navy Department is a proper voucher, and if all legal requirements have been complied with. If found correct in that particular the treasury then proceeds to charge up the voucher to the appropriation indicated on its face, provided of course such appropriation is properly chargeable with such an expenditure. There are thus two distinct questions involved in the auditing of a voucher: *First*, is it in legal form? *Second*, is it chargeable to the appropriation named? The treasury is the only authority on the first question, and the Navy Department must conform absolutely to its rulings. As regards the second question, the treasury is necessarily at a loss, for, as has been shown, many appropriations are often chargeable with a given expenditure. The best the treasury can do is to satisfy itself that at least the appropriation inscribed on the voucher is one of those to which such an expenditure *may* be charged. It therefore rests with the Navy Department to keep the record straight in regard to appropriations, and that is what actually takes place. It is true that there is a large class of vouchers each of which by its nature could be charged to only one appropriation, and the treasury can judge of itself in such a case whether or not the correct appropriation has been inscribed. But as there is also a great number of vouchers for which the treasury has to rely on the navy for the correct appropriation classification, the effect is practically to leave the whole decision in the hands of the navy. Consequently, no advantage in the way of accountability is gained by maintaining the system of many appropriations, considering only the relations existing between the navy and treasury.

As regards the relations between the Navy Department and Congress, we find that Congress approves certain estimates, and that in passing the naval bill these estimates are solidified into separate and distinct appropriations. If emergencies later arise which require the expenditure of sums greater than those estimated in certain cases, it becomes necessary to obtain deficiency appropriations from Congress. At the same time other estimates

y be found greater than needed, but no method is available of ng overestimates to offset underestimates, except that of shift- : charges, to which reference has been made. This method is : to be commended. How much more sensible it would be to initely recognize that estimates are in fact *only* estimates, and enact a naval appropriation bill providing for a total amount de`up of the sum of the estimates which have been approved both Houses of Congress, but not making separate and distinct ropriations in the case of each estimate.

uch a bill should be composed of *general* estimates and *specific* mates. The first would consist of the regular working amounts ch have been called the leading appropriations, and also the plemental amounts for similar purposes; the second would be e sums allowed by Congress for specific projects, such as for lic works, and also for amounts allowed for increase of the y. The second class of estimates would in reality be allot- ts, the amounts not to be exceeded; while the first class would xpended as nearly as practicable in accordance with the esti- s, with proper explanations of all variations. The general nates, should, however, be made up to cover the objects of nditure as laid down by the accounting system, accompanied ich text as would be necessary to substantiate the requests; resent indefinite and misleading wording should of course be doned.

good example of what is meant is found in the current appro- ion " Pay of the Navy." Here we find a group of separate ates for a variety of purposes for which the appropriation is used, and then the clause, " and the money herein specifically priated for ' Pay of the Navy ' shall be disbursed and ac- ed for in accordance with existing law as ' Pay of the Navy ' or that purpose shall constitute one fund." The fact is here nized that the various estimates are based on probabilities, at so long as the total is not exceeded, variations from these ates are permitted.

other example, not quite so clear, is found under " Ord- and Ordnance Stores " of the current act, where we find: *vided further,* That ordnance materials procured under the is ordnance appropriations shall hereafter be available for to meet the general needs of the naval service, under the priation from which procured." The provision has the l effect of 'closing all the ordnance appropriations into

one appropriation, so far as the purchase and use of material is concerned.

An appropriation act passed in the way described above would then be made up of detailed estimates, in which the purpose of each sum would be definitely described. Certain sums would be fixed allotments, not to be exceeded. The others would be simply estimates. The total amount appropriated would then be entered on the treasury books as one sum.

In expending this sum the Treasury Department would continue to exercise its function of passing on the legality of the vouchers submitted. It would make no attempt to classify expenditures under the various estimates. On the other hand, the Navy Department would report to Congress all expenditures made aaginst the corresponding estimates, and would give suitable explanations of all variations made. The estimates and expenditures being made under the same descriptive headings, a complete and satisfactory report would be feasible. Congress would have as much and even more control over the moneys expended than at present, since the best that can now be done is to show on the one hand the expenditures made from the many appropriations, and on the other hand to describe in entirely separate tables the purposes for which money was used.

Another feature should be the cumulation of appropriations from one year to the next, so that there should always be on the treasury books but one appropriation running for current needs. The ordinary practice is to maintain the sums of each fiscal year separate from other fiscal years, and this enormously increases the complexity of accounting. *In each appropriation act the balances remaining from the previous year should be re-appropriated for the ensuing year, and closed in to the new appropriation.* This has already been done in the current appropriation bill, so far as the appropriations for the preceding year are concerned; each distinct appropriation balance being carried forward and credited to its successor. This principle should be carried further, and *all balances should be closed into the one fund.*

It should be evident that the plan proposed differs entirely from the method sometimes designated as that of "lump appropriations," in that detailed estimates are made and finally reported up, which is not true of the usual lump appropriation.

To make clear the plan proposed, the amounts found in the current appropriation act have been rearranged and distributed in

way they would appear under the new system. Following the al preamble would appear:

NAVAL ESTABLISHMENT

'or all necessary purposes of the naval establishment, except the Naval Academy and for the marine corps, in accordance 1 the following approved estimates, $1,412,314,455; *Provided,* t the amount here appropriated shall constitute one fund, shall be disbursed and accounted for as such. And *Provided her,* That the Secretary of the Navy shall report to Congress :xpenditures made for each approved estimate included herein. *Provided further,* That those estimates marked "Specific" in no case be exceeded.

APPROVED ESTIMATES

LE A. FIRST COST OF HULL, MACHINERY AND PERMANENT FITTINGS

fic Torpedo-boat destroyers	$125,000,000
On account of torpedo-boat destroyers heretofore authorized.	
ic Torpedo-boats	32,397,000
On account of submarine torpedo-boats heretofore authorized.	
ic Armor	10,000,000
Toward the armor for vessels heretofore authorized.	
	$167,397,000

TITLE B. SHIPS' EQUIPAGE

Armament for new vessels	$10,000,000
Toward the armament for vessels heretofore authorized.	
*New batteries for ships of the navy	85,014,110
For batteries and outfits for naval vessels, auxiliaries, patrols, aircraft, naval stations and merchantmen.	
NOTE: $41,259,523.50 included in this estimate to meet obligations already incurred.	
Torpedoes and appliances	10,000,000
Ordnance equipage in general	3,000,000
Construction and repair equipage	7,000,000
Steam engineering equipage	3,000,000
Supplies and accounts equipage	1,000,000
Navigation equipage	1,000,000
	$120,014,110

Secretary of the Navy is authorized to incur obligations not to $20,000,000 in addition to this estimate.

TITLE C. COST OF COMMISSION (MAINTENANCE) OF SHIPS

Under Bureau of Navigation	$1,469,800
Under Bureau of Ordnance, ammunition, etc.	8,000,000
Under Bureau of Construction and Repair supplies	6,000,000
Under Bureau of Steam Engineering, supplies	6,000,000
Under Bureau of Medicine and Surgery, supplies	1,000,000
Under Bureau of Supplies and Accounts, supplies	2,000,000
Provisions	50,000,000
Pay	180,000,000
Fuel	25,000,000
	$279,469,800

TITLE D. REPAIRS TO VESSELS

Under Bureau of Ordnance	$2,000,000
Under Bureau of Construction and Repair	13,000,000
Under Bureau of Steam Engineering	16,000,000
	$31,000,000

TITLE K. ALTERATIONS TO VESSELS

Under Bureau of Ordnance	$3,522,279
Under Bureau of Construction and Repair	12,000,000
Under Bureau of Steam Engineering	6,000,000
	$21,522,279

TITLE P. REPAIRS TO SHIPS' EQUIPAGE

Under Bureau of Ordnance	$1,000,000
Under Bureau of Construction and Repair	1,500,000
Under Bureau of Steam Engineering	800,000
Under Bureau of Supplies and Accounts	250,000
	$3,550,000

TITLE X. STORES (RESERVE)

Purchase and manufacture of smokeless powder	$2,400,000
*Ammunition for vessels	73,289,530
NOTE: $23,210,120 included in this estimate to meet obligations already incurred.	
Ordnance supplies (miscellaneous)	63,000,000
NOTE: $30,500,000 included in this estimate to meet obligations already incurred.	
Ammunition for vessels building or authorized	7,000,000
Clothing and small stores	27,000,000
Provisions	15,520,216
Medical stores	1,000,000
	$189,209,746

* The Secretary of the Navy is authorized to incur obligations not to exceed $11,000,000 in addition to this estimate.

of the U. S. Army field uniform through the center, with narrow stripes of red, white and blue on either side.

The obverse of the army badge bears the coat of arms of the Cuban Republic supported on either side by an American soldier, with the legend, "Cuban Pacification," above, the dates, "1906-1909," below; and the obverse of the badge issued to the navy and marine corps represents Columbia presenting the olive branch to Cuba, while the dove of peace hovers above, the legend being, "Cuban Pacification, 1908."

NICARAGUAN CAMPAIGN BADGE

In 1912 a revolution in Nicaragua threatened the disruption of the republic and a force of sailors and marines was landed to establish order and good government. This force inflicted a decisive defeat upon the revolutionists who opposed them and quickly brought order out of chaos. A campaign badge was issued to each officer and man of the navy and marine corps who participated. The ribbon is dark red with blue stripes near each edge, and the obverse of the badge shows the smoking volcanic peak of Mount Momotombo rising from Lake Managua beyond a tropical forest, with the legend, "Nicaraguan Campaign, 1912."

THE MEXICAN CAMPAIGN BADGE

The revolution and counter-revolutions in Mexico between 1911 and 1917 made it necessary for the United States to maintain strong patrols of army troops along the border and of cruisers and gunboats along both the Atlantic and Pacific coasts of that country, to send the punitive expedition across the Rio Grande into Mexico, and to conduct the naval and military operations against Vera Cruz in 1914.

To commemorate this service the badge known officially as the Mexican service badge was issued to the officers and men of the army, navy and marine corps who participated in these operations. The distinctive ribbon of this badge is yellow, blue, yellow, with green edges.

The obverse of the army badge is decorated with a yucca plant in bloom, with hills in the background, and the legend, "Mexican Service, 1911-1917"; and that of the badge for the navy and marine corps shows the old castle of San Juan de Ulloa, with the legend, "Mexican Service, 1914."

TITLE V. MISCELLANEOUS

	Under Office of the Secretary:	
	General administration charges	$4,350,000
	(Report to be made in detail showing distribution of these charges.)	
Specific	Contingent, navy	150,000
Specific	Temporary government for West Indian Islands	200,000
Specific	Expenses of Naval Consulting Board	100,000
Specific	Investigations of fuel oil	60,000
	Aviation	220,383,119
	(Estimate for aviation expenditures included here pending the establishment of proper accounting divisions for all aviation costs.)	
Specific	State marine schools, reimbursement of	75,000
Specific	Care of lepers, Island of Guam	20,000
	Under Bureau of Navigation:	
	Transportation and travel allowance of enlisted men, etc.	12,000,000
	Recreation for enlisted men	150,000
	Contingent and miscellaneous	20,000
	Gunnery and engineering exercises	425,000
	Outfits on first enlistment, etc.	9,975,000
	Instruments and supplies	1,000,000
	Ocean and lake surveys	155,000
	Organizing the naval reserve force	200,000
	Schools or camps of instruction, naval reserve force	2,655,350
	Under Bureau of Ordnance:	
	Repairs to equipage (batteries) and supplies not chargeable to specific ships	5,000,000
	Experiments, Bureau of Ordnance	385,000
	Miscellaneous ordnance expenses	2,000,000
	Contingent	50,000
	Under Bureau of Construction and Repair:	
	Repairs to equipage and supplies not chargeable to specific ships	2,000,000
	Miscellaneous Construction and Repair expenses	2,000,000
	Under Bureau of Steam Engineering:	
	Repairs to equipage and supplies not chargeable to specific ships	1,400,000
	Miscellaneous steam engineering expenses	2,000,000
	Original investigations and extended experimentation of naval appliances	160,000
	Under Bureau of Yards and Docks:	
	Contingent and miscellaneous	250,000

the breach of a rapid-fire gun, and a scroll carrying the motto of the corps, " Semper Fidelis."

The reverse of both medals has the inscription, " Fidelity—Zeal—Obedience," in a circle, enclosing the name of the recipient, the date of his first enlistment and the ship on which he served.

The Gold and Silver Life Saving Medals

Various acts have been passed by Congress authorizing the Secretary of the Treasury to bestow life saving medals upon " any persons who shall hereafter endanger their own lives in saving, or endeavoring to save, lives from perils of the sea, within the United States, or upon an American vessel." The first of these acts, approved by the President on June 20, 1874, authorized two classes of these medals, the first class to be confined to cases of extreme and heroic daring and the second class to be given in cases not sufficiently distinguished to deserve the medal of the first class.

Subsequent acts prescribed that the first class medal should be made of gold and that of the second class of silver. These life saving medals are awarded to both civilians and members of the naval and military services and in the latter case medals and ribbons are worn with uniform in the same manner as the strictly war decorations.

The medals, struck from coin gold or silver, are beautiful examples of the medalist's art and are highly prized as the tribute paid by the nation to individual courage and heroism on the sea.

The Distinguished Service Cross

Under date of January 12, 1918, the President authorized the award of two decorations and two insignia for service in the present world war, the decorations being the distinguished service cross and the distinguished service medal, and the insignia being war-service chevrons and wound chevrons.

The distinguished service cross is of bronze surcharged with an American spread eagle, suspended by a ribbon of dark blue, with narrow stripes of blue and white at each edge. The first hundred of these decorations which were struck had the arms of the cross decorated with oak leaves, but in subsequent ones the leaves were omitted and the cross made plain. The cross is

in a bookkeeping way, although these estimates might serve as a guide from time to time in passing upon the legality of certain payments made. Thus, the treasury might be in some doubt about passing vouchers for the Virgin Islands, were it not for the estimate "Temporary Government for West Indian Islands."

In the Navy Department the bureaus would maintain cognizance of the estimates for which they were responsible, somewhat in the same way as they now manage their appropriations. There would be this great difference, however: allotments of funds for working purposes would always be directly toward the objects of expenditure, with no considerations of various sources of supply, as at present. In deciding whether or not to authorize funds for a contemplated purpose the first and primary point to consider should always be the desirability or necessity of the expenditure. The second point is in regard to how much has already been expended for similar purposes. If expenditures made and contemplated bid fair to exceed the yearly estimate for that particular purpose, the unforeseen reasons should be recorded, so that at the end of the year perfectly definite explanation may be submitted to Congress relative to the over-expenditures. Similarly, estimates which have not been fully utilized should carry a note of explanation in the report. Of course, the total of the whole appropriation could not be exceeded without having obtained a deficiency appropriation.

It is believed that one of the greatest obstacles in the past to amending our appropriation system has been the fact that each year the estimates for the various appropriations could be compared with the estimates of the preceding years submitted in the same form, and a fair check could thus be maintained by Congress, as long as conditions did not greatly vary from year to year. The war has upset all that. It is impossible to gage now the amount needed under a given appropriation by the amounts appropriated last year or the year before. Consequently, now is the time, if ever, to introduce the reform.

The simplest method to pursue would be to add to the naval appropriation bill now in course of legislation, wording about as follows:

Provided, That the amounts here appropriated (except for the Naval Academy and for the marine corps) shall constitute one fund to be called "Naval Establishment" and shall be disbursed and accounted for as such.

And *Provided further,* That the Secretary of the Navy shall report to Congress the expenditures of the naval establishment, divided according to the accounting headings of the naval accounting system, and hereafter all estimates shall be submitted under those headings. And *Provided further,* That the amounts marked " Specific " herein shall not be exceeded.

All unexpended balances of appropriations made for the naval establishment, except for the Naval Academy and the marine corps, shall on June 30, 1919, be transferred and credited to the appropriation " Naval Establishment," and for that purpose such balances are made available for the fiscal year 1920. *Provided,* That all unexpended balances of appropriations for the Naval Academy and for the marine corps shall be transferred and merged with the corresponding appropriations contained in this act.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SYSTEM

By Captain J. F. Hellweg, U. S. Navy

A large number of new ships are being commissioned, particularly small ones, and many of the young officers ordered to them have had little previous experience as commanding officers or heads of departments. These officers will eventually develop some system for handling the details of their work, but at the expenditure of time which could be more profitably devoted to other important duties.

In order to save them this time, the following scheme is published, hoping that it will be of as much assistance to them as it has been to me. I have used this system on four ships and one shore station and it has saved considerable time and effort for all officers responsible for the execution of the work.

The allotment of details to many subordinates prevents the overloading of the various heads of departments, while at the same time insuring execution of the work.

One General Ship's Office

The ideal arrangement on any class of ship is *one general office* with the various heads of departments assigned desk room only There should be *one filing cabinet* of ample size with *one filing system*. This cabinet should be centrally located in the general office. The saving in time in handling correspondence cannot be overestimated. *No papers go out of the office except in the mail*, the risk of loss is reduced therefore to a minimum. All yeomen are under the eye of the chief, necessitating regular office hours. They cannot waste time, hidden in some office with a magazine or newspaper. All yeomen are available for work. Any yeoman seen unoccupied is given the work which next develops. The output is enormously increased without overwork-

ing any of the office force. Inter-departmental correspondence on board ship is eliminated, as everything is handled in one office. Various short cuts are possible, and suggest themselves when the system is tried. I have used this system with marked success and recommend its trial. If all new construction eliminated the old system of numerous small separate offices, and one large well-ventilated and well-lighted centrally located general office was provided, increased efficiency would result. Flat-top table desks with side drawers should be provided, each with chairs on opposite sides of the central opening; one for yeoman and the other for head of department. Typewriter should be secured to a "swing-up" on yeoman's side of desk.

Immediately after receipt of mail, it is logged and thrown to the various desks having cognizance of it; there to be acted upon by the head of the department, *without any waste of time for logging and indexing as is required by the separate office system.* The captain's yeoman logs all mail, notes to whom thrown, acts as head filing clerk, and sees that all letters are promptly acted upon, returned and forwarded. A rubber stamp with numbers from 1 to 12 or higher assists in throwing the mail expeditiously. This column of numbers is stamped on the margin of the letter or on a slip of paper clipped to the letter, and a pencil check is made against the number whose attention is required. The following key for throwing mail will be found satisfactory for the average small ship. Larger ships will have to add additional numbers for their greater subdivision of work:

1. Executive officer.
2. Navigating officer.
3. Ordnance officer.
4. Communication officer.
5. Chief engineer.
6. Medical officer.
7. Pay officer.
8. Information of all officers. To be initialled and passed on. Last one to return papers to office.
9. Post a copy on bulletin board.
10. File.
11. Place contents or requirements of this letter on a card in tickler system.
12. First lieutenant.

The captain, sitting at his desk, can dictate letters to his yeoman seated opposite. He can discuss any questions with his heads of departments without their leaving their desks, and can obtain their views IMMEDIATELY *instead of as now,* with our old-fashioned push-the-button-and-wait system. How much time do you suppose is wasted daily in the entire fleet, waiting for some one who has been sent for?

All records and correspondence are immediately available, ***with the certainty that they are all there*** and not scattered through two or three other offices, as is possible at present with the separate office system. The general office spells *co-ordination, team-work,* and *speed,* without which complete success can never be attained. This system is the antithesis of the "one-man-shop."

ROUTINE INSPECTIONS

The following synopsis explains the details of the system of inspections: "Inspections required by the Naval Regulations, Fleet Regulations, and Ship's Regulations, will be carefully made and logged in the proper records." "In order to eliminate the possibility of overlooking any inspections, all have been arranged in groups."

The requirements regarding each inspection are recorded on separate cards (standard 3-inch by 5-inch size), and each card numbered consecutively in its own group. Thus, while the weekly inspections are allotted numbers 10 to 40, up to the present time the cards are only up to and including number 29.

The groups given below are recorded on a standard 3-inch by 5-inch card in tabular form. Alongside of each group is entered in pencil the number of the highest card in that group. This synopsis of inspection cards will be found of assistance in several ways.

LIST OF ROUTINE INSPECTIONS

(White Cards)

			Weekly Routine	
Daily Routine	1–9	2		
Weekly Routine	10–40	29	Monday	10–12
Fortnightly Routine	41–45	41	Tuesday	13–16
Monthly Routine	46–65	55	Wednesday	17–20
Quarterly Routine	66–85	75	Thursday	21–24
Semi-Annual Routine	86–100	88	Friday	25–27
Annual Routine	101–120	106	Saturday	28–29

The following copy of routine inspections listed by the above synopsis, shows the cards in my tickler. If each is copied on a standard sized card, they will be ready for tickler file.

1

SMOKELESS POWDER. DAILY.

Examine all powder samples of all indexes daily in a good light without removing stopper. Observe whether normal condition and appearance. Presence of reddish-brown fumes indicates decomposition of powder. Feel for temperature, as decomposition is accompanied by heat.

S. O. 22.

2

MESS GEAR. DAILY.

Mess gear inspected by petty officer in charge. Reported to executive if unsatisfactory regarding cleanliness, quantity, or if broken.

(Ship.)

MONDAY

10

HAMMOCKS, BEDDING. WEEKLY.

Bedding aired from 8 a. m. to 1 p. m. twice weekly. Hammocks inspected. While airing, hammock nettings thoroughly cleaned out. Owners of dirty hammocks or bedding restricted pending their cleaning. Inspection made by O. O. D. and P. O.'s of divisions. Logged in deck log.

Fleet Regs., 1917, Art. 403.

11

AUXILIARY MACHINERY. WEEKLY.

All auxiliary machinery inspected and tested weekly. To be made by chief engineer and executive, assisted by C. M. M.'s, C. W. T., C. G. M., and C. C. M., respectively. Results to be logged in engineering and deck log books, respectively. All auxiliary machinery to be moved by hand daily, and once weekly by steam.

N. I. 3045, 3046.

12

STOREROOMS, HOLDS. WEEKLY.

Storerooms, holds, etc., will be inspected weekly. Made by first lieutenant and medical officer, assisted by the C. P. O.'s of departments and storeroom keepers. Results to be logged in weekly hull book, accompanied by recommendations for necessary corrections or improvements.

N. I. 2702 (2) and 2115.

TUESDAY

13

ELECTRIC PLANT. WEEKLY.

To be thoroughly tested once weekly. Test to be made by electrician under supervision of chief engineer. Log results in steam log book.
(Ship.)

14

SMALL ARMS. WEEKLY.

To be inspected and overhauled weekly. Made by chief gunner's mate under supervision of ordnance officer. Log results in chief gunner's mate's inspection book, and in deck log book. Any losses or defects to be noted. Survey prepared immediately to cover necessary parts.
(Ship.)

15

DRAINS, VALVES, MECHANICAL DEVICES. WEEKLY.

All drains, strainers, cocks, valves, water-tight doors, hatches, slides and all mechanical devices for safety or handling of ship will be inspected and tested weekly. Made by executive and chief engineer, assisted by C. P. O.'s of various departments. Results to be logged in deck and engine-room logs, weekly hull book.
N. I. 2506, 2605, 2622, 3042-44, 3054, 3102, 3106, 3107, 2702.

16

SAFETY VALVES. WEEKLY.

Safety valves will be lifted on cold boilers by hand once weekly, and will be tested on other boilers. Careful inspection to be made of hand lifting gear, etc. Made by chief engineer, assisted by C. W. T. Log results in egine-room log.
N. I. 3073.

WEDNESDAY

17

PRIMERS, DETONATORS. WEEKLY.

Inspect magazines, primers, detonators, and smokeless powder samples weekly. Made by ordnance officer, assisted by C. G. M. Log results in C. G. M.'s inspection book and deck log.
R. 2027; N. I. 2311, 2628, 2811.

18

FLOOD COCKS. WEEKLY.

Flood cocks will be tested weekly. Made by ordnance officer, assisted by C. G. M. Results logged in deck log book and C. G. M.'s inspection book.
N. R. 2027.

19

SEARCH-LIGHT. WEEKLY.

Search-light inspected and tested weekly. Best done during daylight hours when load is small on machine. Inspect circuit, carbons, mirror, and lenses, to insure readiness for immediate use. Log results in engineer's log book.

20

COLLISION MAT AND GEAR. WEEKLY.

All collision gear will be inspected weekly after collision quarters, and defects repaired. Made by executive and divisional officer handling mat.
(Ship.)

THURSDAY

21

DECK, CHESTS, BOAT BOXES. WEEKLY.

To be inspected weekly by officer of the deck, assisted by C. B. M., C. G. M., and others having deck chests. Boat boxes to be inspected by officers in charge of boats, assisted by coxswains. Any omissions, losses, etc., to be noted. Prepare survey for missing articles. Log in deck log.
(Ship.)

22

NOZZLES, FIRE HOSE, SPANNERS. WEEKLY.

All fire hose, nozzles, spanners, and other fire fighting gear to be inspected weekly by executive, assisted by the divisional officers and C. P. O.'s. Log inspection and any losses or defects in deck log. Prepare survey for missing articles.
(Ship.)

23

WHEEL ROPES, STEERING GEAR. WEEKLY.

Wheel ropes, steering gear, hand gear, relieving tackles, etc., to be inspected weekly by navigator, assisted by C. Q. M., and other Q. M.'s. Log inspection and results in deck log.

24

HAMMOCKS, BEDDING. WEEKLY.

(Copy inspection card No. 10.)

FRIDAY

25

BAG INSPECTION. WEEKLY.

Inspected weekly. Clothes mended, brushed, and cleaned. Any man with soiled clothing in bag to be restricted till cleaned. Inspection by division officer.
Fleet Reg., 1917, Art. 403.

26

BILGES. WEEKLY.

Pumped, cleaned, and inspected. Then inspect pump strainers, bilge suctions, etc. Made by executive and chief engineer, assisted by the storeroom keepers and C. P. O.'s of various departments. Storeroom keepers keep bilges clean under their storerooms.

(Ship.)

27

BATTERY. WEEKLY.

Inspect and overhaul battery weekly. Ordnance officer and G. M.'s guns' crews assisting. Any defects or losses logged in deck log book and C. G. M.'s inspection book. Prepare survey for any parts missing or broken.

SATURDAY

28

HULL INSPECTION. WEEKLY.

Weekly Hull Board inspections can be made any time during the week. Results will be logged in the hull book by each officer. Book to be checked weekly by executive and submitted to captain by noon Saturday.

N. I. 2701 (4), 2702, 2703, 2704, 2705 (2).

29

SHIP AND CREW. WEEKLY.

By captain, executive, chief engineer, ordnance officer and first lieutenant. Log results in deck and engineer's log books.

41

SMOKELESS POWDER. FORTNIGHTLY.

The powder in one or more charges of each index is visually inspected for signs of decomposition or change of appearance.

S. O. 22.

46

LEAD LINES, LOG, SOUNDING MACHINE. MONTHLY.

Check accuracy of lead lines. Inspect patent log and sounding machine monthly. Made by C. Q. M. under navigator's supervision. Log inspection in deck log book. Made and logged the first day of the month.

I. 1605.

54

FIRE EXTINGUISHERS, APPARATUS. MONTHLY.

Fire extinguishers, fire apparatus, hand pumps, etc., are to be inspected monthly by executive officers, assisted by C. C. M., and any omissions or defects corrected. Log inspection in deck log.

N. I. 2331 (3).

55

OIL LAMPS AND LANTERNS. MONTHLY.

All oil lamps and lanterns are to be lighted and kept burning for a sufficient time to insure their being ready for use. Log inspection in deck log.

N. I. 2607 (13).

66

BOILERS, FURNACES, ETC. QUARTERLY.

Inspect all boilers, furnaces, brick-work, casings, etc., once quarterly. See dry pipes and internal feed-pipe holes clear. Made by chief engineer, assisted by C. W. T. Log results in engineer's log book. (Boilers to be inspected after 700 hours steaming.)

N. I. 3064 (1), (4).

67

DOUBLE BOTTOMS. QUARTERLY.

Inspect all reserve feed tanks, bilges, etc., throughout ship for condition of rivet heads, butt-straps, condition of paint, etc. Made by executive and chief engineer. (Quarterly board.) Log results in hull book and inspection in deck and engineer's log books.

N. I. 2702 (1).

68

FUEL TANKS, BULKHEADS, ETC. QUARTERLY.

Inspect plating and bulkheads, separating fuel-oil tanks and compartments from other compartments. Also done whenever oil is received on board. Made by chief engineer, assisted by C. W. T. Log result in engineer's log book.

N. I. 2702 (1).

69

STORES, CABLES, SPARE PARTS, ETC. QUARTERLY.

Inspect all stores, spare parts, cables, hawsers, sails, etc., once quarterly. Cables will be scaled, painted; swivels, shackles, pins, etc., overhauled, refitted, and greased. Made by heads of all departments. Log results in deck and engineer's log books.

N. I. 2636 (1), 2631 (7).

70

COAL BUNKERS. QUARTERLY.

Coal bunkers will be inspected once a quarter and the condition of the bulkheads and protective coating very carefully noted in hull book and the steam log book.

N. I. 2705 (3).

71

ALL MACHINERY NOT IN STEAM ENGINEERING. QUARTERLY.

Inspect all machinery not under Bureau of Steam Engineering. Submit data for report on condition for bureaus concerned. Made by chief engineer, assisted by C. P. O.'s. Log results in the engineer's log book.

R. 2808 (1).

72

HULL BOARD. QUARTERLY.

Hull Board will thoroughly inspect all parts of ship, etc., in accordance with N. I. 2701 (1), 2702, 2703, 2704. Board consists of three commissioned officers (one engineer officer). See 2701 (1). Log results in hull book and note inspection in deck and engineer's log books. Note special report regarding inspection on docking.

(2704.)

73

WAR HEADS. QUARTERLY.

Routine inspection of war heads. See ordnance instructions. Made by ordnance officer. Log results in deck log book.

74

HOLDING DOWN BOLTS, ETC. QUARTERLY.

Inspect all holding down bolts, nuts, bearing blocks, casing bolts, etc. Made by chief engineer and logged in engineer's log book.

N. I. 3046.

75

MESS OUTFITS, INVENTORIES. QUARTERLY.

All mess outfits, officers' and general mess are to be inspected, inventories made and missing articles accounted for.

N. R. 3042; N. I. 828, 2233, 4427, 4428.

86

CONDENSERS. SEMI-ANNUAL.

Inspect condensers, tubes, zincs, etc., at least once in six months. Made by chief engineer. Log results in engineer's log book. If much steaming has been done, examination should be made more frequently. Any signs of grease, immediately boil out with soda, if necessary.

N. I. 3050 (3).

87

SURVEILLANCE TEST, SMOKELESS POWDER. SEMI-ANNUAL.

Made in accordance with ordnance instructions once every six months. Log results in deck log book. Made by ordnance officer, assisted by C. G. M. If not provided with oven, send samples twice a year to nearest magazine, where test will be made and report submitted to ship.

S. O. 22.

88

PRESSURE TEST OF TORPEDO FLASKS. SEMI-ANNUAL.

See ordnance instructions regarding pressure tests of certain flasks. Made by torpedo officer at navy yard when possible.

101

OUTBOARD DELIVERIES, VALVES. ANNUAL.

Inspect all outboard valves, deliveries, zincs, propellers, etc., when docked. Made by Hull Board. Log results in both log books and hull book.

N. I. 2703 (1), (2).

102

FUEL-OIL TANKS. ANNUAL.

Inspect fuel-oil tanks and compartments inside. Made by chief engineer. Log result in engineer's log book.

N. I. 2702 (3).

103

AIR COMPRESSORS. ANNUAL.

Inspect and test air compressors and all parts of air pressure system in accordance with ordnance instructions. Made by torpedo officer. Log in deck log book.

104

TURBINES. ANNUAL.

Lift turbine casings and sight rotors. Made by chief and logged in engineer's log book.

N. I. 3044 (1), (2).

105

INVENTORY OF ALL SUPPLIES. ANNUAL.

All storerooms will be broken out and an inventory will be made of all stores, spare parts, etc., on board. Surveys will be prepared to cover any discrepancies. Inventory will be made by supply officer. Date of commencement and completion will be logged in log book.

N. I. 2231 (1).

is found in the naval instructions of to-day, and illustrates pretty well our attitude of mind in regard to the distinctions between appropriations.

As a matter of fact, the question of which appropriation to use for a given piece of work is one that is constantly arising, and is not only a serious difficulty, but usually causes a vexatious loss of time. A recent example is as follows:

The supply officer at a navy yard having worked out, in conjunction with the Public Works Department, a plan for the installation of certain sand unloading machinery, correspondence took place, of which the following is an abstract:

(a) The public works officer states that his department has no funds available for the equipment. That it is portable equipment similar to other kinds, the property of the storehouse. Requests information as to whether supply officer concurs, as further action is dependent upon determining which bureau shall pay for the equipment.

(b) Supply officer considers the installation properly chargeable against a public works appropriation.

(c) Public works officer does not consider argument used by supply officer as sound; furthermore, as prospect of obtaining funds for project from Bureau of Yards and Docks is not bright, suggests that supply officer take such steps as are practicable towards purchasing the equipment.

(d) Commandant approves.

(e) Supply officer submits requisition under "Maintenance, Supplies and Accounts."

(f) Bureau of Ordnance returns requisition, as not chargeable to appropriation indicated. States that it appears to be chargeable to appropriation "Naval Gun Factory Tool and Machine Plants."

This correspondence consumed over two months. A perfectly conscientious effort was made by all concerned to properly locate this charge. It will be noted, however, that the problem was to determine the *source* from which the funds were to be obtained. The proper head under which to record the expenditures when made, that is, the expense classification, was not even considered. The accounting system will handle that phase of the matter with ease, no matter what appropriation supplies the funds.

The naval accounting system has recognized that an accurate statement of purposes for which money has been expended is essential, the mere record of the amount expended from each appropriation being insufficient. Each expenditure is therefore located under one of the main "titles" of the naval establishment, descriptive of the purpose for which the money was used. Thus,

directing the collection of data requiring considerable time, the memo. is placed sufficiently far in advance of the required date to collect the data and submit the report on time.

If directions necessitate repeated reporting at regular intervals, the requirements are recorded on a regular card, properly labelled and filed in its proper group.

If the requirement necessitates action only in the event of certain other occurrences, a permanent card is prepared and filed under a special group called *when occurring*. If the occurrence repeats itself, a reference to the *when occurring* group will furnish data regarding necessary action to be taken.

Each card carries at its bottom the article of the Navy Regulations or Fleet Regulations requiring the inspection. The more complete the synopsis on the card is, the greater help the card will be in future work. For instance, if the file number of correspondence pertaining to the subject is noted, all information on hand is immediately available to assist you in the case under investigation, saving much time.

If this system is intelligently supervised, it is practically impossible for you to forget anything, or to be late in complying with the numerous requirements of existing orders.

Everyone knows how difficult it is to locate information in the Regulation Book occasionally. Having located the desired information once, why repeat the search six months or a year later? Why not make a brief synopsis on a card and file it in your tickler. The next time you need the information you will have it immediately. Do not try to remember such details; if your brain is choked with details, you may lose sight of more important matters. Let your tickler keep you posted about all routine matters.

THIS SYSTEM ADDS A BIG PERCENTAGE TO THE AVAILABLE TIME OF THE WORKING DAY, as it releases your mind from all monotonous details and makes time available for other matters. It is astonishing how little time is required to supervise the routine work after the system is understood and is running. In addition, you have the certainty that nothing is being overlooked.

THE FILING SYSTEM

The filing system consists of the usual modern vertical filing system and the *day book*. Letters and reports are filed in stiff

folders to which they are secured by clips. Folders represent subject exclusively. I recently saw an attempt made to file letters by titles of bureaus, offices, names, etc. It was hopeless, inadequate, restricted, and confused. All naval officers have a certain familiarity with filing systems, and to permit the installation of such an inadequate system proves my claim: THAT THE ROOT OF MUCH EVIL IS LACK OF PROPER SUPERVISION.

One advantage of the system which is advocated in this paper is its flexibility. It grows as your requirements increase, and does not necessitate any very elaborate mapping prior to its establishment. The ideal method of indexing is to use index cards with JUST ENOUGH cross-indexing to cover normal requirements, but not to make a picture puzzle. KEEP A BRIGHT LOOKOUT FOR *overorganization*. Nearly all clerks and yeomen inherit this trait, and if not carefully supervised, will build a system requiring unnecessary labor. Remember that "Work makes work" and so on the tail is wagging the dog.

Instead of using index cards, some yeomen prepare two pamphlet lists on official size paper; one an alphabetical and the other a numerical list. This scheme has some advantages from the yeoman's point of view, although I do not consider it as good as the index card system.

One of the most important parts of any filing system is its *day book* or chronological record of all outgoing and incoming correspondence. The following instructions which are pasted in the front cover of the *day book* are self-explanatory. It was found necessary to make them a part of the book in order to prevent yeomen from forgetting, in the beginning only, the routine, or making unauthorized changes adversely affecting the completeness or simplicity of the scheme.

THE DAY BOOK

"This book is a chronological record of all outgoing and incoming correspondence. To be of value, it must be *absolutely* complete in all details. If complete, it will save much time in locating correspondence."

"The book is divided into two parts:

Pages 1 to 100: Letters and reports sent.

Pages 102 to 200: Letters and reports received."

"*Letters and Reports Sent.*—This part records in tabular form to whom each letter is sent, the subject of the letter, where filed, and any remarks. Each day's record is complete and follows the previous day's record, from which it is separated by two or three blank lines, on one of which the current day's date is stamped. This scheme results in each day's record forming a complete group under its own date, the separated groups adding clearness and greater facility in searching for correspondence."

"Endorsements are recorded in this section as letters sent, and under the remarks column a note is made indicating it is an endorsement."

"*Letters Received.*—This form is similar to the first section, except that it requires a double page for complete entry instead of a single page. It contains columns for recording the following data: From whom the letter is received. His file number. The date of his letter. Our file number. The subject of the letter and a column for remarks. The last two items, requiring most space, are given the entire right-hand page of each pair. The other items and one small blank column for indicating to whom the correspondence is thrown, occupy the left-hand page."

"Each day's record is separated from the previous day's group by the same scheme as in the first part of book."

Procedure.—Immediately upon receipt of mail, the date of receipt is stamped on each letter in the middle of the bottom margin. This scheme facilitates locating dates, as they can be seen by merely turning over the bottoms of the letters like turning over the pages of a book.

After stamping dates, all letters are logged in sequence in *day book,* first having started the day's record by stamping date in the middle of the page two lines below the last entry of the previous day.

All letters are then delivered to the captain. After glancing through them to acquaint himself with their requirements, he indicates by the key numbers to whom letters are to be referred for action.

The yeoman records in pencil in the blank column on left-hand page of "Letters received" the key numbers of officers, and then delivers letters. When letters are returned to captain's desk the key numbers are checked, and letters are filed or otherwise disposed of.

If answer is required, data is given in pencil memo. when letter is returned to captain's yeoman; or, answer may be prepared for captain's signature.

After a reasonable time, all officers against whom letters are charged will be notified as a check against their overlooking them.

Officers to whom letters are referred will initial same alongside their key numbers.

The operation of the system is much simplified where a general office is possible; but it will work equally well in an old ship, except that the captain's office takes much of the work.

The one thing to keep in mind is DO NOT OVERORGANIZE. Before you make any change—a one-time mistaken navy synonym for improvement—calculate the cost, and see if you can show a saving of 6 per cent on the investment. If you can, go ahead; it is good business. If you cannot, do not touch it. This applies equally well both to labor and energy as well as to dollars and cents. Captain F. R. Clark, U. S. Navy, gave me that advice when I went to Indian Head. It was his only advice, but it covered every case fully, and I advise all hands to try it in their work afloat as well as ashore.

A glance at this model of the numerical index (page 576) shows that sub-heads can be increased indefinitely without disturbing any others. This renders the system very elastic, capable of fitting the most detailed or the most general correspondence. All file numbers are entered on correspondence in pencil. If at any future date the subdivision of any folder appears desirable, a new folder can be started, a new sub-number assigned, the new number marked on the faces of the letters to be shifted, and noted in the file column of the *day book*.

All letters sent and received regarding the same subject carry the same file number ONLY. No attempt is made to give them special numbers in their folders, they are filed chronologically with the most recent date on top.

All ships having separate offices will require copies of the alphabetical and the numerical indexes in each office, so that each can prepare its letters as far as possible for the captain's signature, thereby relieving his office of much routine work. Do not conclude from this that the captain is a rubber stamp. Before any letter is drafted, the captain and all the officers interested

11 Battery, guns, ordnance cards *re* battery.
11–1 Guns, sights and gun mounts.
11–2 Practice, target, report of, correspondence *re*.
11–3 Electrical fire control, pipes voice, telephones, fire control reports and correspondence *re* ordnance cards, *re* fire control.

11–4
11–5
11–6

12 Books, signal battle and signal.
12–1 Books, library, professional, etc., library.
12–2 Confidential publications, receipts for, etc.
12–3 Logs, steam, deck and engineering, receipts for, etc.
12–4 Publications other than confidential.
12–5
12–6

13 Boats, landings, equipment, etc.
13–1
13–2
13–3

14 Boilers, general correspondence *re*.
14–1 Boilers, furnaces, cements, etc., paints boiler furnace.
14–2 Boilers, safety valves, settings, etc.
14–3 Boilers, grate bars.
14–4 Boilers, fittings.
14–5
14–6
14–7

15 Charts, correspondence *re*.
15–1 Hydrographic information, aids to navigation.
15–2 Anchorages, information *re* harbors, correspondence *re*.
15–3 Pilots, correspondence *re*.
15–4 Bases, correspondence *re*.
15–5
15–6

16 Clerks, mail. Mail.
16–1 Censorship, correspondence *re*.
16–2
16–3
16–4

in the subject discuss the matter fully. After a decision is reached, the letter is written and it *represents the combined opinion of all interested parties.* It is remarkable how quickly such conference methods clear up most situations and promote the "get-together" spirit. The results are obvious.

ROUTINE REPORTS

(Pink Cards)

Each report is recorded on a separate card (3 inches by 5 inches) in the same manner as *inspections,* the cards pink in color. They are given sequence numbers, and are arranged in the same groups with the *inspections* cards. There is also a synopsis card showing all reports. The following is a model:

LIST OF ROUTINE REPORTS

When Occurring	1–40	32
When Unsatisfactory	41–50	44
Weekly	51–60	54
Monthly	61–80	77
Quarterly	81–100	88
Semi-Annual	101–125	111
Annual	126–150	141

The third column is in pencil and indicates the highest numbered *report* card in each group.

The following is a complete list of *report* cards taken from my tickler. If each is copied on a separate card in the same form, they will be ready for filing in the tickler:

1

ALL TRANSFERS OF ENLISTED MEN, STRAGGLERS, DESERTERS OR DEATH. — WHEN OCCURRING.

To: Bureau of Navigation.
Form: 1B.
By: Executive through C. O. direct to BuNav.
Ref.: N. I. 5221 (9).
The delivery or surrender of a deserter is reported to BuNav. direct on S.&A. form 228.
File: 8-1. Copy in executive's office.

2

CHANGES OF OFFICERS. — WHEN OCCURRING OR WHEN SAILING ON AN EXTENDED CRUISE.

To: Bureau of Navigation.
Form: N. Nav. 64.
By: C. O.
Ref.: N. I. 5221 (23).

3

SURVEY AND APPRAISAL. — WHEN OCCURRING.

To: Bureau concerned.
Form: Request. S.&A. 153 and 153a. Report of survey, S.&A. 154-1, 154-2.
By: Head of department through C. O. (N. I. 4731-1). Case less than $100 requires three copies. More than $100, C. O. forwards to S. O. P. who appoints three officers (I. 4733-1, 2), four copies required. Cases lost on receipt require five copies. See I. 4731-8, 2, 9, 10; I. 4733-2. Also see Manual of Supply Officers Afloat, 1917, Art. 467 and 246.

4

HEAT TEST OF POWDER. — WHEN OCCURRING.

To: Bureau of Ordnance.
Form: N. Ord. 67.
By: Ordnance officer through C. O.
Copy to fleet commander.
File: 4-1.

5

REQUESTS FOR REPAIRS. — WHEN OCCURRING.

To: Department bureau concerned.
Form: Letter. Separate one for each bureau and for each class.
By: C. O.
Ref.: N. I. 4331.
File: 34-1 to 34-6.

6

REQUEST FOR LEAVE OF ABSENCE. — WHEN OCCURRING.

To: Fleet commander or S. O. P.
Form: Letter.
File: 8-6.

7

REPORT OF SPECIAL SURVEY IN ORDNANCE. — WHEN OCCURRING.

To: Bureau of Ordnance.
Form: Ord. 20.
By: Ordnance officer.
File: 28-2.

the way they would appear under the new system. Following the usual preamble would appear:

NAVAL ESTABLISHMENT

For all necessary purposes of the naval establishment, except for the Naval Academy and for the marine corps, in accordance with the following approved estimates, $1,412,314,455; *Provided,* That the amount here appropriated shall constitute one fund, and shall be disbursed and accounted for as such. And *Provided further,* That the Secretary of the Navy shall report to Congress the expenditures made for each approved estimate included herein. And *Provided further,* That those estimates marked "Specific" shall in no case be exceeded.

APPROVED ESTIMATES

TITLE A. FIRST COST OF HULL, MACHINERY AND PERMANENT FITTINGS

Specific	Torpedo-boat destroyers	$125,000,000
	On account of torpedo-boat destroyers heretofore authorized.	
Specific	Torpedo-boats	32,397,000
	On account of submarine torpedo-boats heretofore authorized.	
Specific	Armor	10,000,000
	Toward the armor for vessels heretofore authorized.	
		$167,397,000

TITLE B. SHIPS' EQUIPAGE

Specfic	Armament for new vessels	$10,000,000
	Toward the armament for vessels heretofore authorized.	
	*New batteries for ships of the navy	85,014,110
	For batteries and outfits for naval vessels, auxiliaries, patrols, aircraft, naval stations and merchantmen.	
	NOTE: $41,259,523.50 included in this estimate to meet obligations already incurred.	
	Torpedoes and appliances	10,000,000
	Ordnance equipage in general	3,000,000
	Construction and repair equipage	7,000,000
	Steam engineering equipage	3,000,000
	Supplies and accounts equipage	1,000,000
	Navigation equipage	1,000,000
		$120,014,110

* The Secretary of the Navy is authorized to incur obligations not to exceed $20,000,000 in addition to this estimate.

16

DOCKING REPORTS. WHEN OCCURRING.

To: Bureau of Construction and Repair.
Form: Letter.
By: Hull Board through C. O. and C.-in-C. or S. O. P.
Ref.: N. I. 5222 (1) (b) and 2704 (2).
File: 24.

17

REQUESTS FOR ALTERATIONS. WHEN OCCURRING.

To: Department bureau concerned.
Form: Letter. Separate letter for each bureau and class.
Ref.: N. I. 4331, 4311 (10).

18

DRAFT AND LOAD ON DEPARTURE. BEFORE DEPARTURE FROM NAVY YARD.

To: Commandant.
Form: N. C. R. 125.
By: C. O. through Hull Division, sufficiently in advance of departure to permit draft being verified by an officer from that department prior to sailing.
Ref.: N. I. 5221 (35).
File: 22-1.

19

REPORT OF STRAGGLERS. ON DEPARTURE FROM PORT.

To: S. O. P.
Form: Letter.
By: C. O. prior to departure, giving list of names absent, with notation of rewards offered.

20

HOSPITAL TICKET. WHEN OCCURRING.

To: Hospital or hospital ship.
Form: G (one copy).
By: M. O. through C. O.
File: M. O.'s file.

21

REPORT OF CASUALTIES. WHEN OCCURRING.

To: Commander-in-chief, S. O. P.
Form: Letter.
By: C. O.

22

REPORT OF EPIDEMICS. WHEN OCCURRING.

To: Bureau of Medicine and Surgery.
Form: Letter. One to base commander, one to bureau.
By: M. O. through C. O.
File: M. O.'s file.

23

BOILER INSPECTION REPORT. WHEN OCCURRING.

To: Commander-in-chief, S. O. P.
Form: Special fleet form.
By: Chief engineer through C. O.
File: 14.

24

MEDICAL REQUISITION. WHEN OCCURRING.

To: Bureau of Medicine and Surgery.
Form: 4.
By: M. O. through C. O.
File: M. O.'s file.

25

SURVEY OF MEDICAL PROPERTY. WHEN OCCURRING.

To: Commander-in-chief, S. O. P., for appointing board.
Form: Ca.
By: M. O. through C. O.
File: M. O.'s file.

26

MEDICAL SURVEY. WHEN OCCURRING.

To: Commander-in-chief for appointing.
Form: Request for survey, Form L. Report of survey, Form M.
By: M. O. through C. O.

27

REPORT OF DEATH. WHEN OCCURRING.

To: Bureau of Medicine and Surgery.
Form: N. 3. Copy for base commander.
By: M. O. through C. O.
File: M. O.'s file.

28

MISCONDUCT REPORT. WHEN OCCURRING.

To: C. O. and pay officer.
Form: Admission and discharge.
By: Medical officer.
Copies for C. O., P. O., and enlistment record.
File: M. O.'s file.

29

REPORT OF TRANSFER OF PATIENTS TO OTHER THAN NAVAL HOSPITALS. WHEN OCCURRING.

To: Bureau of Medicine and Surgery through S. O. P. for approval.
Form: Letter. Copy for base commander.
By: M. O. through C. O.
File: M. O.'s file.

30

EFFICIENCY REPORT OF HOSPITAL CORPS. WHEN OCCURRING.

To: Bureau of Medicine and Surgery
Form: 238.
By: M. O. through C. O.
File: M. O.'s file.

31

RECOMMENDATION FOR G. C. M. WHEN OCCURRING.

To: Commander of base, force, or fleet.
Form: Letter forwarding following as enclosures: (1) Specimen charges and specifications; (2) statement by accused; (3) statements by all witnesses; (4) list of witnesses, both prosecution and defense; (5) complete copy of current enlistment record on N. Nav. 1B, marked in conspicuous place with age and length of service; (6) statement of pay accounts; (7) report of M. O. regarding man's fitness to remain in service.
Ref.: Fleet Regs., 1917, Art. 1002.

32

COMMUNICATION WITH AMERICAN DIPLOMATIC OR CONSULAR OFFICIALS. WHEN OCCURRING.

To: U. S. diplomatic or consular official in port.
Form: Letter, or by officer messenger.
Ref.: Fleet Regs., 1917, Arts. 502, 503.

41

CONDITION OF MACHINERY UNDER C. & R. WHEN CONDITION IS UNSATISFACTORY.

To: Bureau of Construction and Repair.
Form: Letter.
By: Chief engineer (C. O.).

42

REPORT OF ELECTRICAL MACHINERY. WHEN CONDITION IS UNSATISFACTORY.

To: Bureau of Steam Engineering.
Form: Letter.
By: C. O. (engineer officer).

43

REPORT OF MACHINERY. WHEN CONDITION IS UNSATISFACTORY.

To: Bureau of Steam Engineering.
Form: Letter.
By: C. O. (engineer officer).

Report No. 44 is purely a destroyer report dealing with the unsatisfactory condition of oil (fuel) hose.

51

VACANCIES IN CREW. WEEKLY IN U. S. PORTS. 15TH AND 30TH ABROAD.

To: Bureau of Navigation.
Form: N. Nav. 25.
By: C. O.
Copies to base commander and force commander.
File: 8-8. Vacancy report filed in executive's office.

Report No. 52 is one that is not in force during war time. It pertains to reports regarding number of men qualified in swimming during the current week.

53

REPORT OF PROGRESS OF REPAIRS. WEEKLY AT A NAVY YARD.

To: Force commander.
Form: Letter.
By: C. O.
File: 34-9.

54

EMPLOYMENT OF AUXILIARY PATROL AND ESCORT. WEEKLY.

To: Base commander.
Form: Special.
By: C. O.

The following *monthly* reports apply purely to destroyers and are therefore not quoted. Nos. 61, 64, 68, and 69, referring to general mess accounts, engineering competition reports, summary of orders to pay officer, and summary of material drawn for the month.

62

SMOKELESS POWDER TESTS. MONTHLY. ALSO QUARTERLY, SEMI-ANNUALLY AND ANNUALLY.

To: Bureau of Ordnance.
Form: N. Ord. 67.
By: Ordnance officer through C. O.
Reporting all monthly tests. (See inspections.) One copy.
File: 4-1.

63

TARGET PRACTICE. MONTHLY.

To: Base commander.
Form: Letter.
By: Ordnance officer through C. O. Copy to force commander.
File: 11-2.

65

SPECIAL MUSTER ROLL. MONTHLY.

To: Bureau of Navigation.
Form: Letter.
By: Commanding officer. Showing complete alphabetical list of men on board arranged in three groups: (1) U. S. Navy; (2) U. S. Naval Reserve; (3) National Naval Volunteers. List also shows any changes made during month since last report.
Copies to: Base commander (1).
Ref.: Force commander's cable 139; base commander's letter 26 October, 1917.
File: 8-8. Muster roll filed in executive officer's office.

66

TEMPERATURE OF MAGAZINES. MONTHLY, WHEN TEMPERATURE IS OVER 90°.

To: Bureau of Ordnance.
Form: N. Ord. 43.
By: Ordnance officer (C. O.) through fleet commander. Also enter on back under remarks, temperatures of outside air, both maximum and minimum, on days on which temperatures of 90° or above are reported.
Ref.: C.-in-C.'s letter 114, 12 January, 1912.
File: 4-1.

67

ROSTER OF OFFICERS. MONTHLY.

To: Force commander.
Form: Special (F. C.'s). Replaces N. Nav. 343.
By: Commanding officer. In triplicate on 1st of month. Through base commander to force commander (1) (original) direct. Bureau of Navigation (1).
Ref.: Bureau Cir. L. 17-17, October 10, 1917, Par. 13.
File: 32-1.

68

SANITARY REPORT. MONTHLY.

To: Commander of base.
Form: Letter in accordance with base commander's medical instructions, 31 December, 1917.
By: M. O.
Copies to: Base commander (1), force commander (1), through B. C.
File: 202.

70

REQUESTS FOR TRANSFER. MONTHLY.

To: Bureau of Navigation.
Form: Letter giving list of all men requesting transfer or exchange. See BuNav. circular letter 3281-21, May 3, 1912.
By: Commanding officer.
File: 8-1.

71

REPORT OF ENLISTMENTS. MONTHLY WHEN ANY OCCUR.

To: Bureau of Navigation.
Form: 4B.
By: Executive officer through C. O.
Ref.: I. 5221 (6).
File: 8-5.

72

RADIO OPERATORS REPORT. MONTHLY.

To: Bureau of Navigation. Division of Radio, Radio, Va.
Form: N. Nav. 30.
By: C. O.
Copies to: F. C. and B. C.
Report also called "Men Detailed for Radio duty Report."

74

SMOOTH LOG BOOK. MONTHLY OR WHEN COMPLETED.

To: Bureau of Navigation.
Form: 20.
By: Navigator through C. O.
Copy: Rough, retained on board in loose leaf binder.
Ref.: I. 5221 (4).
Filed: Navigator's log room.

75

STATISTICAL REPORT. MONTHLY.

To: Bureau of Medicine and Surgery.
Form: N. M. S. K. (quarterly report form).
By: M. O. through C. O.
Copies to: Bu. M. & S. through B. C. (1), base commander (1), force commander (1), through B. C.
File: M. O.'s office.

76

ABSTRACT OF PATIENTS. MONTHLY.

To: Bureau of Medicine and Surgery.
Form: N. M. S. F. (quarterly report form).
By: M. O. through C. O.
Copies to: Bu. M. & S. through B. C. (1), base commander (1), force commander (1), through B. C.
File: M. O.'s office.

77

LIBERTY AND LEAVE BREAKING. MONTHLY.

To: Base commander.
Form: Letter.
By: C. O.
Copy to: F. C.

81

INSPECTION OF HULL. QUARTERLY.

To: Bureau of Construction and Repair.
Form: N. C. R. 1.
By: C. O. (Hull Board).
Filed in pocket in front of Hull Book.
Ref.: I. 5222 (1) (a).

82

STEAM LOG. QUARTERLY.

To: Bureau of Steam Engineering.
By: Engineer officer.

83

DESCRIPTIVE MUSTER ROLL. QUARTERLY.

To: Bureau of Navigation.
Form: N. Nav. 5.
By: Executive. Forwarded by C. O.
(F.) (Art. 5221 I, Sec. 3. (5)).
Ref.: BuNav. cir. L. 31-17 of 9 November, 1917. Recapitulation, summary of discharge, desertions, deaths, and citizenship will not be filled out. Note omissions required by 31-17, Pars. 2 and 3.
File: 8-8. Muster roll filed in executive's office.

84

CONFIDENTIAL RADIO PUBLICATIONS. QUARTERLY.

To: Director of Naval Communications.
Form: Letter.
By: Radio officer through C. O.
Reporting numbers, etc., of all publications.

85

CRUISING REPORT. QUARTERLY AND WHEN SHIP GOES OUT OF COMMISSION.

To: Office of Operations.
Form: N. Nav. 81.
By: C. O.

In submitting this report for quarter ending (June 30), or when ship is placed out of commission, total distance steamed during entire fiscal year or for period of commission will be entered.
Ref.: 5221 I. (38).
File: 19.

87

COAL (FUEL) REPORT. QUARTERLY.

To: Bureau of Supplies and Accounts.
Form: N. S. & A. 115.
By: C. O. (engineer officer).
(F.)
Ref.: I. 5221 (41).
File: Engineer's log room.

88

ENLISTMENT RECORDS. QUARTERLY.

Quarterly, all enlistment records are completed, efficiency marks recorded, and reports entered.

102

REPORTS OF FITNESS. SEMI-ANNUALLY AND ON DETACHMENT, September 30 and March 31.

To: Bureau of Navigation (direct).
Form:
By: C. O.
Art. 707 I.

103

GUN MOUNTS. SEMI-ANNUALLY, OR WHEN CHANGES OCCUR OR WHEN GOING IN OR OUT OF COMMISSION, June 30, and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 40.
By: Ordnance officer.

When mounts are transferred from one ship to another or to station, this card is filled out and will accompany the transfer. Duplicate to bureau.
File: 11-1.

104

PROJECTILES (AMMUNITION CARD). SEMI-ANNUALLY, OR WHEN ANY CHANGES OCCUR ON COMMISSIONING AND GOING OUT, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 42.
By: Commanding officer.
Copy to flotilla commander.
Whenever ammunition is transferred from one ship to another or to a shore station, card properly filled out will accompany the transfer. Duplicate will be sent to Bureau of Ordnance. Operations 27741-648. S., October 20, 1912, *re* defects in ammunition discovered to be reported in detail.
File: 4.

105

POWDER (AMMUNITION CARD). SEMI-ANNUALLY, OR WHEN ANY CHANGES OCCUR ON COMMISSIONING AND GOING OUT, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 41.
By: Commanding officer.
Copy to flotilla commander.
When ammunition is transferred from one ship to another or to a shore station, card will be filled out and accompany transfer. Duplicate being sent to the Bureau. Operations 27741-648. S., October 20, 1912, *re* defects in ammunition discovered to be reported in detail. Forward powder tags where powder is defective, etc.
File: 4.

107

GUNS, SMALL ARMS. SEMI-ANNUALLY, WHEN CHANGES OCCUR OR WHEN GOING IN OR OUT OF COMMISSION, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 39. Small arms reported on same card.
By: Ordnance officer.
Copy to flotilla commander.
File: 11.

108

ORDNANCE EQUIPMENT. SEMI-ANNUALLY, WHEN COMMISSIONING, CHANGES OCCUR, GOING OUT OF COMMISSION, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 70.
By: Ordnance officer through C. O., copy to flotilla commander.
File: 11.

109

FIRE CONTROL CARD. SEMI-ANNUALLY, WHEN GOING IN OR OUT OF COMMISSION, WHEN CHANGES OCCUR.

To: Bureau of Ordnance.
Form: N. Ord. 51.
By: Ordnance officer.

Whenever any changes affecting data on cards occur, a card reporting such changes only is submitted, both by sending and receiving ship, copy of card to accompany shipment. Give bureau numbers on instruments.

File: 11-1.

110

REQUISITION AND PRICED INVOICE. SEMI-ANNUALLY.

To: Bureau of Medicine and Surgery.
Form: B. Four copies. Forwarded for approval.
By: M. O. through C. O.
File: M. O.'s office.

111

STATEMENT OF EXPENDITURES OF TITLE "B" MATERIAL OF EACH DEPARTMENT. SEMI-ANNUALLY, June 30 and December 31.

To: Bureau of Supplies and Accounts.
Form: Letter, showing inventory of values by departments of all articles under title "B" only, both articles on board and separated from the ship but still considered as belonging to ship. *In preparing statement* see Bu. S. & A. letter 200-10 200-306 of March 25, 1913.
By: Commanding officer.

126

MEDICAL HISTORY (OFFICERS). ANNUALLY, January 1.

To: Bureau of Medicine and Surgery.
Form: All loose sheets containing medical history from form H-Green.
By: M. O. through C. O.
File: M. O.'s office.

127

INVENTORY OF MEDICAL PROPERTY. ANNUALLY, July 1.

To: Bureau of Medicine and Surgery.
Form: D and Da (one copy).
By: M. O. through C. O. and C.-in-C.
File: M. O.'s office.

128

ANNUAL REPORT. ANNUALLY on June 30, and detachment of C. O., C.-in-C.

To: Commander-in-chief.
Forms: Fleet forms 5 and 7.
By: C. O. through flotilla commander. See N. I. 916.
In quintuplicate: Three to C.-in-C., two to flotilla commander.
Folder: 13.

129

STATISTICAL REPORT. ANNUALLY, July 1.

To: Bureau of Navigation.
Form: N. Nav. 109B.
By: C. O., giving statistics of the enlisted force.
Art. 5221 I, Sec. 3 (1).
File: 8-8.

130

INVENTORY OF COMPASSES. ANNUALLY, June 30. Also see "When Occurring" report No. 10.

To: Bureau of Navigation.
Form: 9 and 12.
By: C. O.
(F.)
Ref.: I. 5222 (2) (c).

131

SEAGOING AND OTHER QUALITIES. ANNUALLY, June 30.

To: Bureau of Construction and Repair.
Form: 2.
By: C. O.
Annually after sufficient data have been collected.
Through fleet commander (F.).

132

STEAMING COMPETITION. ANNUALLY, June 30.

To: Navy Department.
Form: Special.
By: C. O.
Through fleet commander.
(F.)

133

ELECTRIC PLANT REPORT. ANNUALLY, June 30. On commissioning.

To: Bureau of Steam Engineering.
Form: N. S. E. Nos. 31 and 33.
By: Engineer officer through C. O.
Form: 31 and 33 to be made by destroyers but once a year, on June 30.
Electric logs not required from destroyers.
Ref.: I. 5222 (4) (b).

134

RECRUITING STATISTICS. ANNUALLY, January 1.

To: Bureau of Medicine and Surgery.
Form: X (one copy).
By: M. O. through C. O.
To be submitted annually, showing any recruiting done during the year.
File: M. O.'s office.

135

AMMUNITION EXPENDITURE. ANNUALLY, June 30.

To: Bureau of Ordnance.
Form: N. Ord. 70a.
By: Ordnance officer through C. O.
BuOrd. letter 27777 (I) 6/20 circular No. 4, April 19, 1913, requires annual report of expenditures of ammunition for fiscal year and cost thereof.
File: 4.

136

EQUIPAGE, TITLE "B" BALANCE SHEET. ANNUALLY, June 30.

Balance sheet for equipage, title "B," together with abstract of receipts and expenditures.
To: Bureau S. & A.
Form:
By: Supply officer through C. O.

137

PHYSICAL TEST OF OFFICERS. ANNUALLY, January 1.

To: Bureau of Navigation.
Form:
By each officer through C. O. reporting having completed all tests for previous year, and including record of physical examination for current year. (Waived during war times.)

138

PAY OF ENLISTED FORCE. ANNUALLY.

To: Bureau of Navigation direct.
Form: 270.
By: P. O. Report showing the pay of the enlisted force for specified month. The bureau sends out the form and the flotilla paymaster prepares it for the ship. It is signed by C. O. and then forwarded.
Art. 5221, Sec. 3 (2) I.

139

BATTLE SIGNAL BOOKS, GENERAL SERVICE RADIO CODES TACTICAL SIGNAL. ANNUALLY, January 1, or when relieved of command.

To: Naval Operations.
Form: N. Nav. 2Q, N. Nav. 1Q.
By: C. O. (direct).
All registered numbers of all confidential publications issued by operations are to be listed in this annual report.
Ref.: I. 5221 (39).
File: 12 and 12-2.

140

SANITARY REPORT. ANNUALLY, January 1.

To: Bureau of Medicine and Surgery, through the C.-in-C. for approval and forwarding.
Form: Letter. Three copies, one to M. & S., one for base commander.
By: M. O. through C. O.
File: 202.

141

DESCRIPTION OF RADIO PLANT. ANNUALLY, December 31.

To: Steam Engineering through C.-in-C.
Form: N. S. E. 25.
By: Senior engineer officer through C. O.
In duplicate: C.-in-C. (1), Department (1).
Copies to F. C. and B. C.

The "system" has been paid the most sincere flattery, having been copied repeatedly by many ships, both destroyers and others, including battleships. It is probable, therefore, that a number of officers are acquainted with the system.

The tedious detail work entailed in perfecting this system, the careful searching through files, regulation books, and pamphlets, to collect the data for *inspections* and *reports*, and the tabulation of data was done by my wife who spent over four months in 1910 to insure the system's accuracy.

Since her original successful efforts, I have attempted to keep it up to date. Everyone who contemplates using the system is advised to check it to insure that it covers the requirements of his particular type of ship.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WINNING THE ENGINEERING WHITE E

By COMMANDER BRUCE R. WARE, JR., U. S. Navy

In December, 1915, the U. S. S. *Texas* was standing about 14th in the engineering competition. She finished the year June 30, 1916, in second place, having gained 13 places in six months; the next year, however, she finished in first place and won the white E.

The first step towards winning the competition was taken at a conference in the senior engineer officer's stateroom. Here it was agreed by all hands, deck, ship and engineers, to get together in earnest in order to win, not only the white E, but the gunnery trophy and the battle efficiency pennant. The order of the day from then on was to be "Co-operation for the ship!"

Therefore, with the welfare of the entire ship in view, each officer was assigned the duties for which he was best fitted. Thus assigned, we all started to get acquainted with our ship. Careful inspections and intensive observations were made of the crew and the machinery. Operating data, pressures and other values were recorded at all points throughout the ship.

About a week before the fleet went to Guantanamo in January, 1916, the data accumulated were analyzed and it was decided to concentrate at once upon the following three points:

1. To get the crew interested.
2. To systematize.
3. To teach and encourage true economy:

The winning of the gunnery trophy proved the success on deck. The co-operation received below from the deck also merits notice. From here on, however, this article will treat with the engineering struggle into the first place.

47

AIR PORTS, HATCHES. MONTHLY.

Inspect all air ports, hatches, doors, etc. See gaskets free from paint, and rubber alive. Log inspection and results. Make necessary repairs. Made by C. C. M., and reported to executive. Made and logged the first day of the month.

N. I. 2331 (8).

48

CHAIN CABLES. MONTHLY.

Chain to be ranged on deck to 60 fathoms for careful inspection of welds. Monthly.

N. I. 2631 (1).

Two reliable petty officers' sole duty on heaving in chain to watch each link as it comes in for signs of cracks in welds.

N. I. 2631 (3).

First inspection made by executive and C. B. M. Inspection and condition logged in deck log book.

49

UPTAKES, BOILER CASINGS. MONTHLY.

Inspect air spaces between uptakes and boiler casings, also casings. Made by chief engineer and C. W. T. Log results in engineer's log book.

N. I. 3069 (1), (2).

50

AIR AND CIRCULATING PUMP VALVES. MONTHLY.

All air and circulating pump valves to be inspected monthly by chief engineer. Inspection and results logged in engineer's log book.

N. I. 3048.

51

FEED TANK, CONDENSERS. MONTHLY.

Inside surface of feed tank and condensers inspected by chief engineer, assisted by C. M. M. Log inspection and results in engineer's log book.

N. I. 3050 (3), 3053.

52

GENERAL MESS ACCOUNTS. MONTHLY.

Inspect storerooms, take inventory of stores preparatory to calculation of mess standing, auditing, etc.

(Flotilla.)

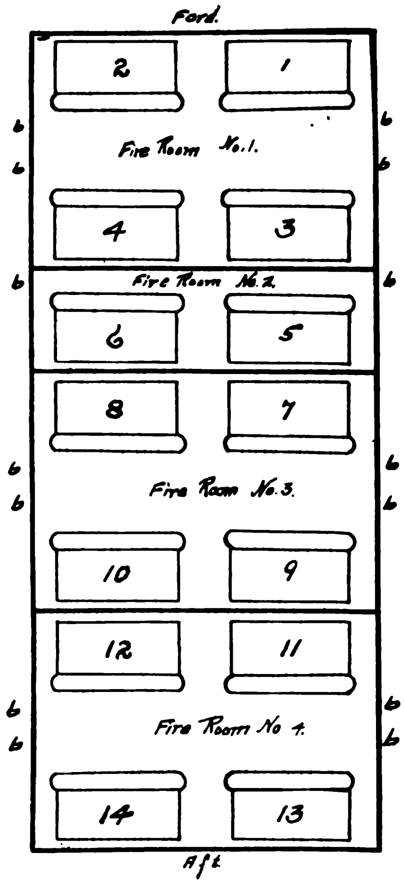
53

LITMUS TEST, SMOKELESS POWDER. MONTHLY.

Make prescribed litmus test of all powder samples. If test fails, the surveillance test is to be begun at once. Made by ordnance officer. Log results in deck log.

S. O. 22.

urgent to adopt correct methods. Accordingly, colored slides were made and illustrated lectures on firing were immediately started. The system of firing taught and developed differed materially from any system in use ashore or afloat.



SKETCH NO. 1.—Boiler Layout.

The boiler layout is shown in Sketch No. 1. All the boilers are fitted with superheaters excepting Nos. 5 and 6 in fire-room No. 2. There are four furnace doors to each boiler. The bunker doors are indicated by the small *b's*. The forced draft blowers, two for each fire-room, one port and one starboard, are directly over the fire-rooms. In order that the men would benefit from

the lectures, it was necessary to be most clear and to use simple language. They were, therefore, made to realize from the start that there were only three things for them to learn and understand: The necessity of team-work; the proper use of the tools given them; the coal and the air.

THE FIRST TALK

In order to understand the system of firing to be explained to you, it is necessary to know something about the things you have to use. To burn coal—that is, to have a fire—there must be air passing through the coal. There is something in the air which the fire must have in order to burn and create the heat that is to be passed on to the water in the boiler. This is oxygen, and without it the fire will not burn; if the supply is too small the fire will smoke and there is the loss due to unburned coal going out the smoke-pipe; if there is too much oxygen the combustion will have been completed too soon and only cold air will reach the important parts of the boiler. About 21 parts of the air is oxygen and if it is all used in the furnace you are tending, then you are doing the very best that is possible.

In naval boilers on board ship such perfect combustion cannot be reached and from 12 to 14 per cent CO_2 formation is considered very good work. The *oxygen* uniting with the *carbon* in the coal forms what is known as carbon dioxide (CO_2) and, as stated, if the smoke-pipe gases contain over 12 per cent the boilers you are firing are doing their duty.

In the plates that I am going to show you I have used colors to designate what is meant. Yellow means that the fire is hot. When you look into the furnace and see a mass of brilliant flames—white-yellowish tongues of fire—that mass or spot needs coaling. Red means that the fire is burning well and should not be disturbed, it may be given a sprinkling of coal. The green is used to indicate green coal—coal that has not had time to burn, or coal that had no air. This part of the fire does not need coal, it may require working by the hoe from above or it may need slicing beneath it. Blue stands for coking—a very bad, wasteful practice, as the air cannot get through the fire and the coal cokes, it does not burn. This blue crust must be broken. The black is the ash or clinker that must be removed. You should now know what the colors mean when I show you the lantern slides.

Before using the lantern, however, it is necessary that you understand the importance of team-work.

Team-work throughout the entire department is required. This means working together. As an example: Illustration No. 1: Boilers Nos. 1, 2, 3 and 4 and boilers Nos. 11, 12, 13 and 14 are steaming. Orders are given to clean fires in boilers Nos. 1, 2, 13 and 14. This should not be done until boilers Nos. 11, 12, 3 and 4 have their fires built up and are in good shape to keep the steam up. In other words, if the boilers that are to carry the greater part of the load are given a slight reserve by, say, heavier fires, the shock will be cushioned when the load is thrown on them. A football player always braces himself as the quarterback calls the signals. As the fires to be cleaned are being burned down, work the others up so that they may be well braced to take the strain when the signal comes to clean fires. Illustration No. 2: Chief water tenders must have all their fires of the same thickness so that a few (thin) fires will not be taking all the draft, this will make work at the fires equal. Illustration No. 3: Water tenders must keep their water level constant with 3 or 4 inches in the glass, it should never go up or down over ½ an inch and the chief water tender must have the same water level in all his steaming boilers, this will help the firemen. Illustration No. 4: Firemen, third class, must keep the fire-rooms neat and swept up (a *fireman* on the fires should not have to do this). Firemen, third class, detailed to get out coal can greatly assist the fireman by doing the following things: Help by opening and shutting the doors; help by putting the coal handy to all fires (a fireman should not have to reach way over to the other end of the fire-room for a shovelful of coal); help by giving the fireman plenty of space to work in, do not get in his way. In addition to obtaining team-work, the following instructions for carrying fires, for regulating fires and for method of firing will be carefully observed: Any man, fireman (first class, second class, or third class), water tender, chief water tender or of other rating, who has any suggestions and who believes he can better the results obtained will tell the officer of his watch. If you do not agree that this is *the* practicable, economical method of firing and can suggest a better way for saving coal, it is your duty to visit the office and tell your ideas to the senior assistant.

If you find it difficult at first to fire in the manner that follows you must, however, stick to it, obey your orders, and I assure you that before your third steaming watch is through you will find it easier to keep up steam and that it is also easier to clean fires. The fires will not be as dirty and the boilers will remain cleaner and tighter as, by this method, they will not have been subjected to fluctuating heats or unwarranted and harmful "pushing and forcing."

During inspections it has been noticed that the old method of "coking" is being followed. This is a costly method and must stop from now on. Any man found "coking" will be considered as having disobeyed orders and not having the interests of his ship at heart. *Bad* fires are those that are:

a. Not level.
b. Full of holes.
c. Full of hollows.
d. Broken up by slice bar.
e. Of different thickness throughout the furnace.
f. Bad, in that half the fire is coking instead of giving off heat by burning.
g. Bottom of grate dark in spots, light in other spots. The bright spots are getting all the air.
h. Furnace door not shut tight.
i. Furnace door kept open too long, the fire does not burn, it chills.
j. Thick, dark and heavy fires.
k. Covered with crust formations.
l. Low in back, high in front.
m. Unable to see back wall on account of blinding *wall* of white flame which will burn out before reaching the tubes.

FIRING COAL IN THE FIRE BED

When burning soft bituminous coal the best results are obtained if the fires are kept level and rather thin. The best thickness naturally depends upon the coal and the strength of the draft.

As already explained, in the steam-boiler furnace, the hot fuel is made to burn by passing a current of air through it. This current of air supplies the necessary oxygen and carries away the gaseous products of combustion. If, now, the amount of coal in

the grates (that is, the fires are too thick) is in excess for the draft available there will not be sufficient current of air to do the work. Either the draft must be increased or the thickness of the fires reduced. If the speed of the ship is to be constant, use less coal in each shovelful and reduce the thickness. The coal must be fired in small quantities and at short intervals. The fuel bed must be kept level and in good condition by spreading the fresh coal over the thin spots only where the coal tends to burn away and leave the grate bare.

Leveling (by use of hoe) or disturbing (by use of slice bar and hoe) the fuel bed in any way whatsoever must be avoided as much as possible; it means a great deal more work for the fireman and is certain to cause the formation of much troublesome clinker. Furthermore, while the fireman is leveling the fires a large excess of air enters the furnace, and this excess of air greatly reduces the amount of steam made per ton of coal.

The uses of the shovel, hoe and slice bar are as follows:

(a) The *shovel* is to be used to throw coal on the various thin spots and hollows throughout the fuel bed that *need* coal. Coal must be placed in thin layers, never a full heaping shovel of coal. One-half a shovelful is plenty for one complete swing.

(b) The *hoe* is to be used to break a crust; when cleaning fires; hauling ash pans; and to remove a clinker. *Never* for leveling fires. The air and the shovel want to keep the fire level, why not let them do it for you? If you are in New York and want to go to Boston you are not going to Boston, then back to New York and then go to Boston before getting there. So, having opened your furnace door to coal the fire why do it all over again to get it in the right place? You men below open your door, fire your coal then open the door again and push the coal into the right place, where you should have thrown it. Use your shovel correctly, the air will do the rest.

(c) The *slice bar* is to be used to sift ashes through the grate bars and in renewing grate bars; NEVER allow the point of the slice bar to come up off the top of the grate bar. Using it as a lever is harmful, ruins the fire and causes clinkers.

The ash-pit door should be kept open. A large accumulation of refuse in the ash-pit must be prevented, as it is sure to cause an uneven supply of air under the grate. When you are burning coal that shows a tendency to clinker keep your ash-pit clean and

bright. All regulation of draft should be done with the damper and NOT with the ash-pit doors.

PLACING THE COAL IN THE FUEL BED

COVERING THIN SPOTS

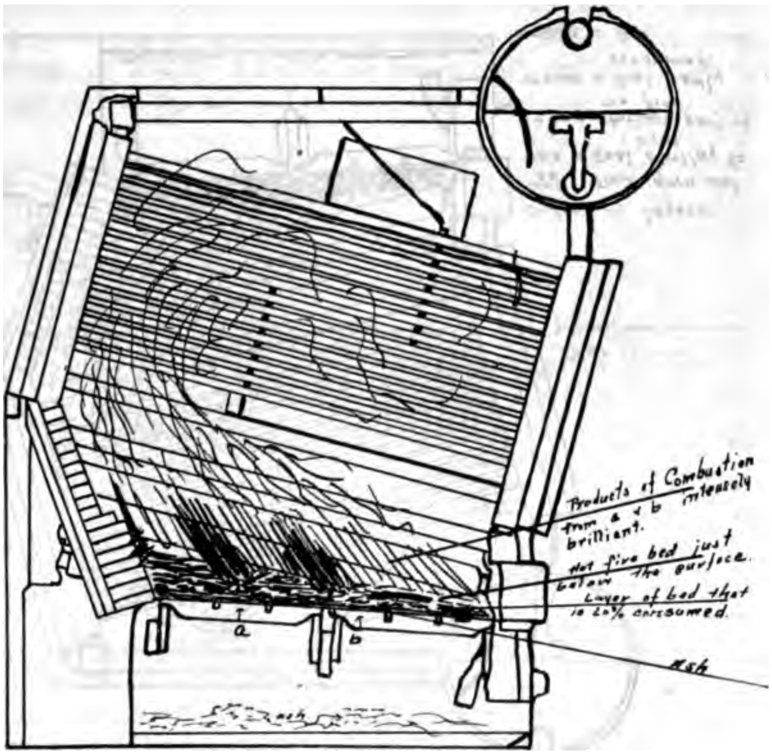
In firing, place coal on the thin spots of the fuel bed. Thin and thick spots will occur even with the most careful firing, because the coal never burns at a uniform rate over the entire grate area. In places where the air flows freely through the fuel bed the coal burns faster than in places where the flow of air is less. The cause of this variation in the flow of the air through the different parts of the fuel bed may be differences in the size of the coal, accumulations of clinkers, or the fusing of the coal to a hard crust. Where the coal burns rapidly, the thin places form.

Break all lumps up before throwing coal into the furnace. Air will flow much faster through lumpy coal than through fine coal. If you have lumpy coal on one part of the grate and fine coal on the rest of the grate, the lumpy part will get all the air and the fine part will not burn.

All the furnaces in a boiler must be fired alike, and therefore one man should fire all furnaces. The air flowing through all grates will have coal fired by the same man and one furnace will not rob another of its air. This can easily be done if firing is properly carried out. The way it is now being done, one man fires and HOES two furnaces, handling the coal twice. Let him fire correctly and he will not have to use the hoe at all; then he can handle twice as many fires, and he will stand a watch in eight or six instead of a watch in four or three. Think this over seriously, men, and realize how much hard work you are saving yourself by firing correctly and by cutting out the hoe.

Before throwing the fresh coal into the furnace, the fireman should take a quick look at the fuel bed and discover the thin spots. In a well-kept fire these spots can be recognized by the bright, hot flame and the colored glass assists in their discovery and location. The thick places with a sluggish, smoky flame or no flame at all will turn blue glass to purple or will turn yellow glass to orange or will turn red to dark crimson. Water tenders must use the colored glass provided and inspect their fires fre-

quently. Sketch No. 2 shows the condition of a well-kept fuel bed immediately before firing; *a* and *b* are the thin spots over which the fresh coal should be spread. In order to place the coal over the thin places the fireman should take a rather small quantity of coal on his shovel, for it is much easier to place the coal where it is needed with small shovelfuls than with large ones.

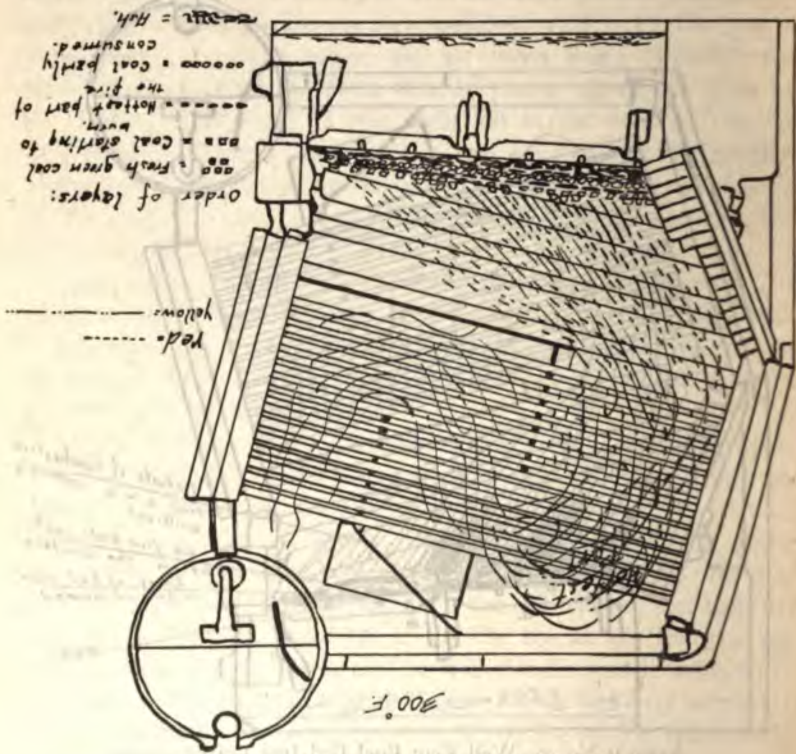


SKETCH No. 2.—Well-Kept Fuel Bed Just Before Firing.

Heaping the shovel means scattering coal over the floor-plates, with the accompanying loss into the bilges, and with coal all over the floor-plates you have a rough foundation to stand on. A good, firm footing is necessary for good firing.

The coal must be placed on the thin spots in thin layers. If you try to fill up the deep hollows in the bed at one firing, the freshly fired coal will fuse into a hard crust and, choking the flow of air, will cause the fire to burn slowly, starting new, high,

thick places. If the high places in the fuel bed are missed on one or two firings the hard crust on the surface will gradually burn through or crack, thus allowing more air to flow through, and the place will get back to its correct condition. BUT if a high place is caused by a clinker the flow of air can never be free and you must remove the clinker at once. Never wait for the bell or the clock if you locate a real large clinker, pull it out.



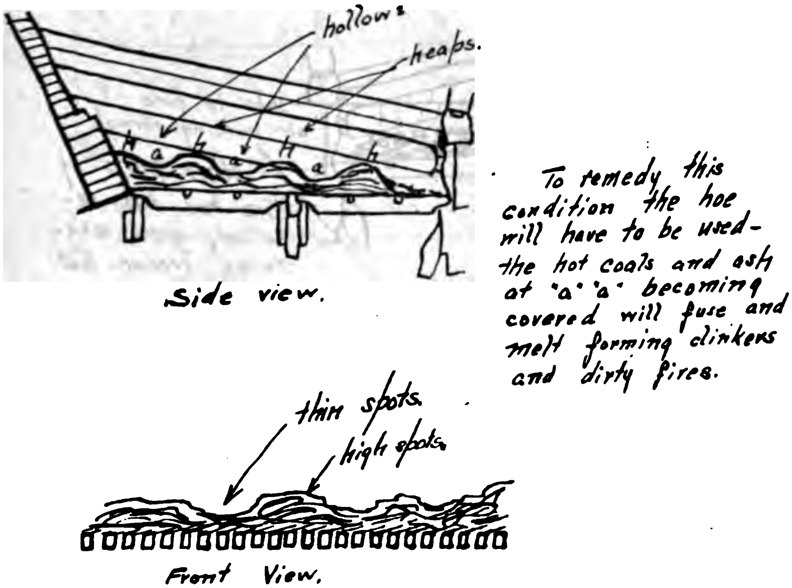
SKETCH No. 3.—A Very Good Fire.

How clinkers are formed will be discussed later. *Whatever may be the cause of the high, thick places in the fuel bed, the fireman must remember that they are places where the coal does* NOT *burn,* or if it burns at all it burns very slowly and must be given time to burn down to the correct thickness.

In Sketch No. 3 will be seen a very good fire with excellent combustion of gases and practically nothing but cold gas leaving the boiler. If the air had entered at 75° F., it may be said to be

leaving in this case at about 300° F. The red and yellows arrows, showing perfect mingling of gases; the red being given off from the high spots green, and the yellow being given off from the low spots, shown yellow.

If the firings are too far apart (that is, too long a time firing interval) the coal in the thin spots may burn away entirely, allowing an excess of air to enter the furnace in streams. If these streams of air are not properly mixed with the gases, only a small part of the air will be used for combustion, a great deal

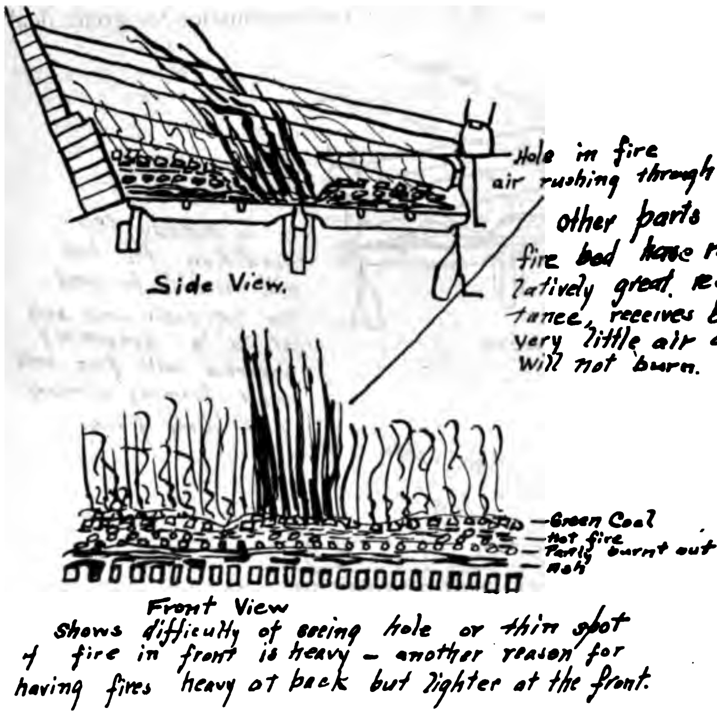


SKETCH No. 4.—Result of Trying to Spread the Coal Evenly, a Bad Practice.

will pass out of the furnace, robbing the boiler of much heat. Let us suppose that air enters the furnace at 75° F. and leaves the boiler at 575° F., it takes away with it the heat that was absorbed (given out by the coal) in raising its temperature 500° F. This heat is lost to the boiler. Another loss of heat occurs when holes form in the fuel bed because pieces of unburned coal fall through the grate when the fireman attempts to cover these holes with fresh coal. For these reasons, to prevent the formation of holes, firing should be made at short intervals, and all the more so if the fuel bed must be kept thin.

NEED OF AN EVEN FUEL BED

It has been stated that a fireman must look before firing and that he must use light shovelfuls, placing his coal on the thin, bright spots. If he persists in spreading the coal evenly over the entire surface it will accumulate in heaps in places where the flow of air is obstructed, and with several firings the fire bed will look as shown in Sketch No. 4.

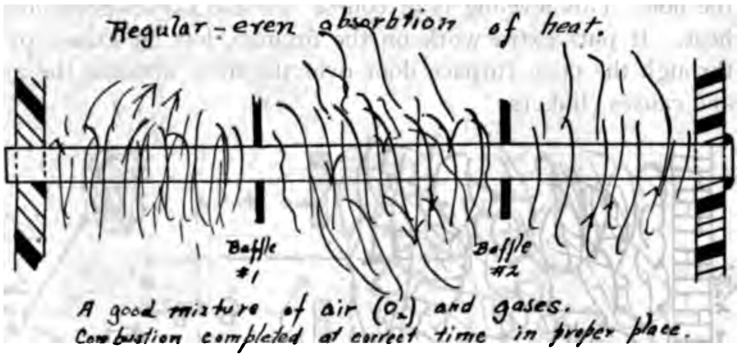


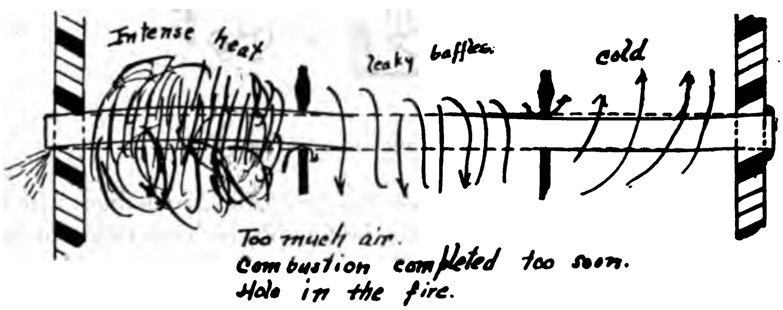
SKETCH No. 5.—Hole Occurring in Center of Grate.

Here we see heaps of coal, *h*, through which little or no air can flow. Coal to burn must have air flowing through it. As the fresh coal at the top of those heaps is heated the volatile combustible is distilled off and rises in columns of smoke and combustible gas, which may pass out of the furnace only half-burned. Among these heaps of coal, *h*, are shown the thin spots, *a*, through which air passes freely, causing the coal in these places, and around the edges of heaps, *h*, to burn with a bright flame. When

the fuel bed gets into this condition it is impossible to see the surface of the thin spots and it becomes very difficult to correctly place coal over them. This state of affairs will lead to the production of holes with admittance of large quantities of excess air.

In Sketch No. 5 is shown a large hole in the center of the furnace. The heaps of coal do not burn, as all the air will rush





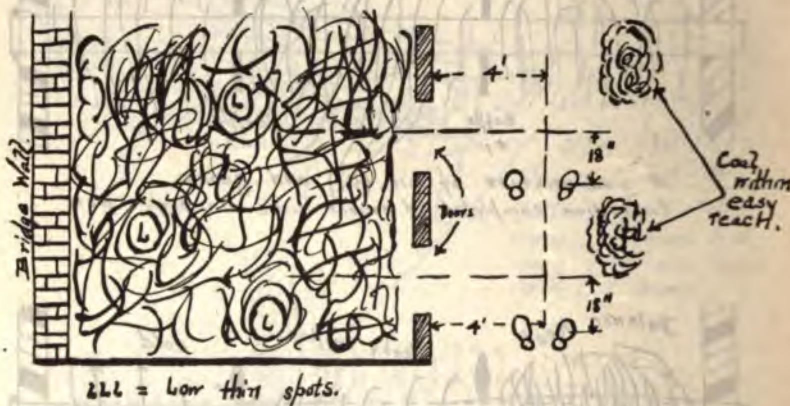
SKETCH No. 6.

through the hole—the air finds nothing to burn so it never becomes heated. The heaps simply distill and smoke and may be partly burned at the edges in contact with the outside of the column of air rushing through. The uneven strain on a tube is shown in Sketch No. 6.

It is well known how bad it is to have cold air strike the tubes of a boiler. In Sketch No. 5 only 80 per cent of the grate is working and then only at very low efficiency, for but little air

works through the masses of coal. The other fires in the boiler are also being robbed of their share of the air supply. The only way to remedy this is to break up the masses with the hoe, start all over again, try to do better and give the air a chance to do some of the work for you.

The quicker way to make such a bed level is to break the caked coal forming the heaps and to spread it over the thin spots with the hoe. This leveling is of course bad and causes great loss of heat. It puts extra work on the fireman, lets an excess of air through the open furnace door over the fires, disturbs the ashes and causes clinkers.



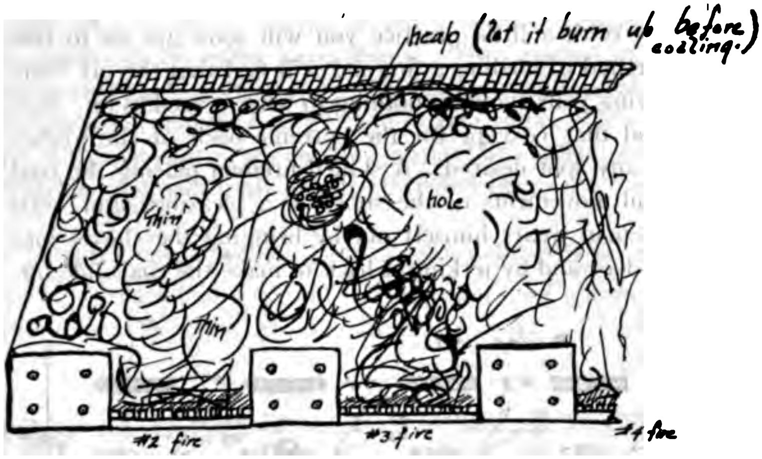
SKETCH No. 7.—Correct Position for Firing.

An unskilled fireman must hoe his fires often, sometimes after every other firing. In doing this he handles his coal twice, once when he throws it into the furnace and again when he pushes it with the hoe where it is needed. A skilful fireman can keep a fuel bed level for hours without hoeing, simply by placing the coal where it is needed; and by doing so he saves himself not only the work of leveling the fires, but also avoids the growth of clinkers, thereby reducing the hardest work to be done in the fire-rooms—CLEANING FIRES—which will be discussed later.

PROPER POSITION IN FIRING

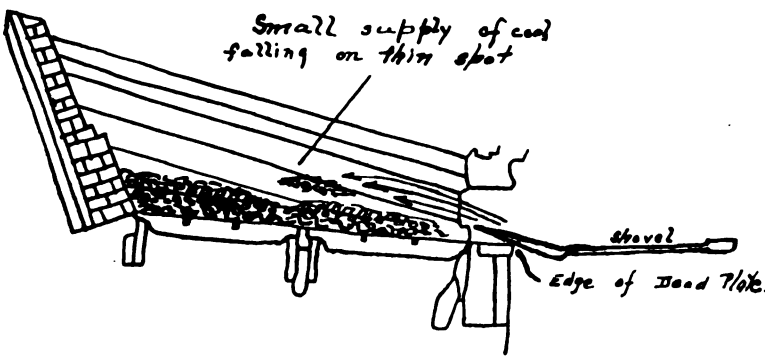
In order to put the coal in the proper place where it is needed, the fireman must stand in a correct position for doing so. The correct position is shown in Sketch No. 7. From this position he

can see the fuel bed, note the thin spots and with the least effort can throw the coal where it is needed. As shown in the sketch,



SKETCH No. 8.—Looking in Furnace Doors.

the fireman is standing from four to five feet from the front of the furnace and 12 to 18 inches to the left of the straight line running through the center of the furnace door. In Sketch No. 8, a front view is shown, showing the fuel bed as seen through the

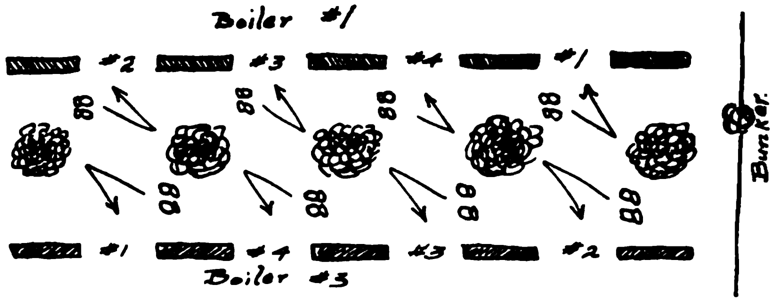


SKETCH No. 9.—Use of Shovel.

furnace door by the fireman. A thin spot is indicated and needs a thin layer of coal.

The fireman standing in the correct position, shown in Sketch No. 7, takes about a half shovelful of coal from the floor-plates, estimates the position of the thin spot and covers it with the coal

in the manner shown in Sketch No. 9. In this sketch, the shovel is shown stopped by suddenly laying it on the bottom of the door frame, the coal sliding off the shovel and landing on the thin spot as desired. With a little practice you will soon get on to this excellent method of coaling a fire and will find that the jar from the coal leaving your shovel is nothing to what it used to be. You will also find that (except for the extreme back of the grate) you can hit any spot desired. A skilled fireman placing the coal with graceful movements of the shovel is a pleasing sight. An unskilled fireman wears himself out by bringing the shovel into the furnace door and by jerking it back to make the coal slide off.



SKETCH No. 10.—Coal Well-Placed for Firing.

It is of course impossible to fire as described above if the fireman persists in heaping his coal up in front of the fires.

If any fireman persists in heaping his coal up in the front part of the grate and has to use his hoe to shove it back, he should be disrated or taken off the fires at once. Not only is he making hard work for himself, but he is wasting coal and shows complete ignorance of how to maintain a good fire.

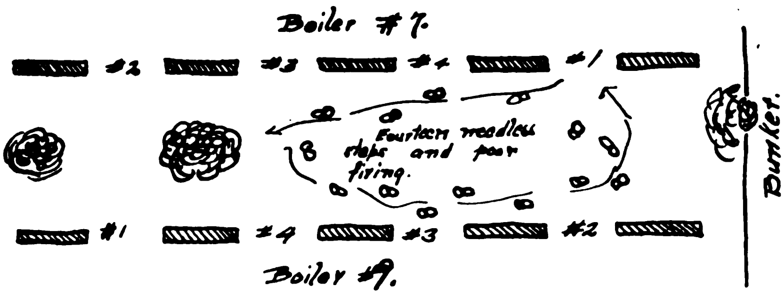
PLACE FOR THE COAL TO BE FIRED

In our fire-rooms we have firemen, third class, who get the coal from the bunkers and dump it on the floor-plates in front of the furnace doors. It is their duty, and the water tender must require, that they place this coal equally along the entire boiler front; that this little ridge of coal is never allowed to become lopsided; and that it must be maintained continuously. Sketch No. 10 shows well-placed coal for firing.

Sketch No. 11 shows that the ridge in front of No. 1 furnace has disappeared, been used up. The fireman in order to coal No. 1 fire has now to reach way over in front of No. 3 for his coal. This is tiring. This is extra work. This means coal scattered all over the floor-plates. This means waste. This shows that the coal-passer is inefficient, that the fireman is listless, that he is not trying to save himself extra work. This shows that the water tender is not on the job and is careless or ignorant. Watches and men must get together and help each other.

WHY THE FIREMAN SHOULD HAVE PLENTY OF ROOM

The furnace doors of our service boilers are not any too large and especially small are the fire-room floors. The small fire-



SKETCH NO. 11.—Coal Poorly Placed for Firing.

rooms make it highly necessary that each fireman has enough clear space to allow him to take the proper firing position, as shown in Sketch 7. Keep out of one another's way. Give the fireman room in which to swing his shovel and make it easier for him to place the coal where it is needed. Give him room so that when firing he does not have to stand so close to the door that he is exposed to the intense heat from the fires. If he is close to the open door, he is sure to stand to one side to avoid this heat, which of course is the wrong position, and he cannot place the coal where needed so down goes the steam, requiring a lot of hard work to get it up to the required pressure again. I cannot recall many times, when inspecting fire-rooms, that I have not seen a lot of coal accumulated on the tops of the ash-pit doors and along the boiler front. A man who has such a dirty boiler front is not standing in the correct, easiest position and

104

PROJECTILES (AMMUNITION CARD).

SEMI-ANNUALLY, OR WHEN ANY CHANGES OCCUR ON COMMISSIONING AND GOING OUT, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 42.
By: Commanding officer.
Copy to flotilla commander.

Whenever ammunition is transferred from one ship to another or to a shore station, card properly filled out will accompany the transfer. Duplicate will be sent to Bureau of Ordnance. Operations 27741-648. S., October 20, 1912, *re* defects in ammunition discovered to be reported in detail.

File: 4.

105

POWDER (AMMUNITION CARD).

SEMI-ANNUALLY, OR WHEN ANY CHANGES OCCUR ON COMMISSIONING AND GOING OUT, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 41.
By: Commanding officer.
Copy to flotilla commander.

When ammunition is transferred from one ship to another or to a shore station, card will be filled out and accompany transfer. Duplicate being sent to the Bureau. Operations 27741-648. S., October 20, 1912, *re* defects in ammunition discovered to be reported in detail. Forward powder tags where powder is defective, etc.

File: 4.

107

GUNS, SMALL ARMS.

SEMI-ANNUALLY, WHEN CHANGES OCCUR OR WHEN GOING IN OR OUT OF COMMISSION, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 39. Small arms reported on same card.
By: Ordnance officer.
Copy to flotilla commander.
File: 11.

108

ORDNANCE EQUIPMENT.

SEMI-ANNUALLY, WHEN COMMISSIONING, CHANGES OCCUR, GOING OUT OF COMMISSION, June 30 and December 31.

To: Bureau of Ordnance.
Form: N. Ord. 70.
By: Ordnance officer through C. O., copy to flotilla commander.
File: 11.

109

FIRE CONTROL CARD.

SEMI-ANNUALLY, WHEN GOING IN OR OUT OF COMMISSION, WHEN CHANGES OCCUR.

To: Bureau of Ordnance.
Form: N. Ord. 51.
By: Ordnance officer.

Whenever any changes affecting data on cards occur, a card reporting such changes only is submitted, both by sending and receiving ship, copy of card to accompany shipment. Give bureau numbers on instruments.
File: 11-1.

110

REQUISITION AND PRICED INVOICE. SEMI-ANNUALLY.

To: Bureau of Medicine and Surgery.
Form: B. Four copies. Forwarded for approval.
By: M. O. through C. O.
File: M. O.'s office.

111

STATEMENT OF EXPENDITURES OF TITLE "B" MATERIAL OF EACH DEPARTMENT. SEMI-ANNUALLY, June 30 and December 31.

To: Bureau of Supplies and Accounts.
Form: Letter, showing inventory of values by departments of all articles under title "B" only, both articles on board and separated from the ship but still considered as belonging to ship. *In preparing statement* see Bu. S. & A. letter 200-10 200-306 of March 25, 1913.
By: Commanding officer.

126

MEDICAL HISTORY (OFFICERS). ANNUALLY, January 1.

To: Bureau of Medicine and Surgery.
Form: All loose sheets containing medical history from form H-Green.
By: M. O. through C. O.
File: M. O.'s office.

127

INVENTORY OF MEDICAL PROPERTY. ANNUALLY, July 1.

To: Bureau of Medicine and Surgery.
Form: D and Da (one copy).
By: M. O. through C. O. and C.-in-C.
File: M. O.'s office.

128

ANNUAL REPORT. ANNUALLY on June 30, and detachment of C. O., C.-in-C.

To: Commander-in-chief.
Forms: Fleet forms 5 and 7.
By: C. O. through flotilla commander. See N. I. 916.
In quintuplicate: Three to C.-in-C., two to flotilla commander.
Folder: 13.

needed. By light, frequent firing, the distillation of volatile combustible is made nearly uniform and it is at all times nearly proportional to the air supply. Fires will be cleaner, better and easier to handle.

In closing this first talk it is desirous to summarize the points brought out. This may well be done by comparing what a GOOD fire is with what a BAD fire is (see page 598).

A *good* fire is one that is:

a. Level.

b. Of proper thickness. Thinner in front.

c. Shoved back from dead plate.

d. Ash-pans bright all over. If the ash-pans are ***brilliantly*** bright the fire is too thin, or there is a hole of large size in the fire, or there are many holes.

e. Top of fire bed light (white flames) all over. Such a fire needs coal when its turn comes.

f. A good fire is one that has an even burst of flame (white) from its entire surface; the bottom of the fire bed has a layer of fine ash that will fall into the grates when the slice bar is swept through it and this will also indicate that the fireman is putting his coal where it is needed.

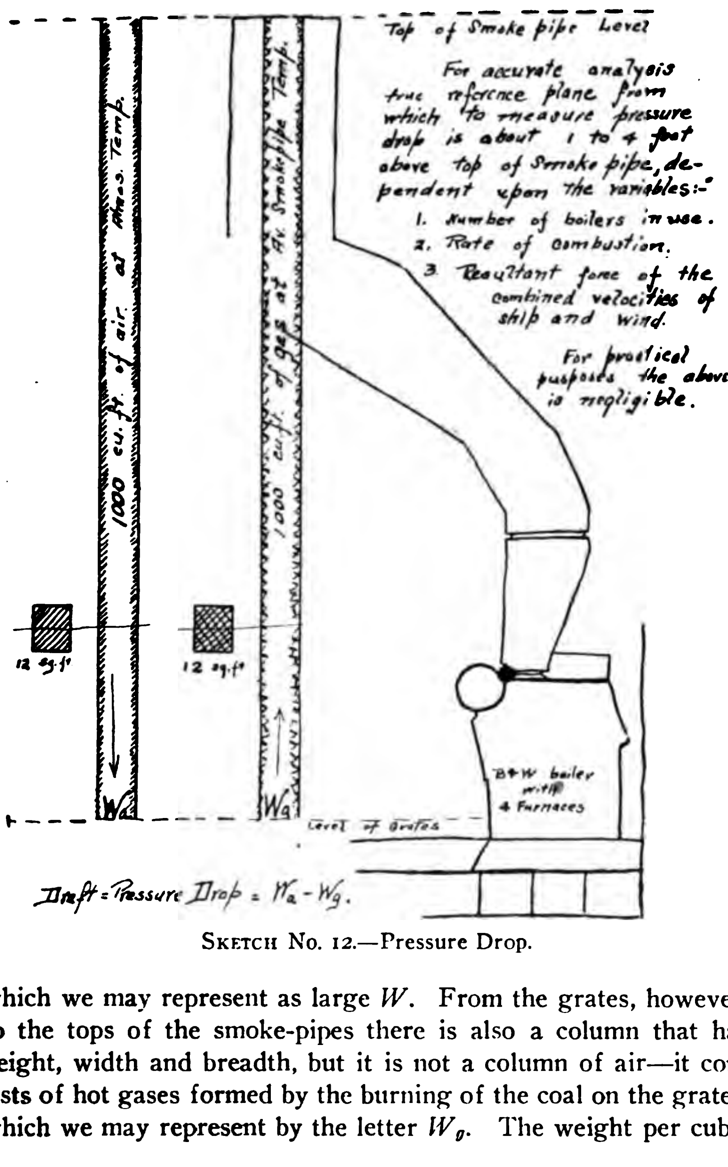
g. Clean boiler front and floor-plates.

THE SECOND TALK

The word "draft" has been much abused by scientists and experimenters, but by the practical, operating engineer it simply names a condition that exists in his heat-producing system of boilers, fire-rooms, uptakes, smoke-pipes, the outside air, ventilators and blowers (either exhausting fans in the uptakes or pressure fans supplying air under the grates). This "condition" produces the flow of air through the grates. It may be such as to cause a lot of air to flow, as occurs when the fire-rooms are closed and the large forced draft blowers are running, or it may be cut down by closing the dampers or stopped entirely by sealing up the boiler front.

There is not a fireman but knows that when the blowers are running it is necessary to carry heavier fires than when they are stopped. As soon as the forced draft blowers are stopped, the ventilators (openings to the outside air) must be opened. Then, instead of having the blowers creating the pressure, there is a

column of air extending from the furnace doors, which may be taken as high as the tops of the smoke-pipes. This column of air is as wide and as broad as the numerous openings, ventilators, hatches, holes, etc., added together, and will have a certain weight



SKETCH NO. 12.—Pressure Drop.

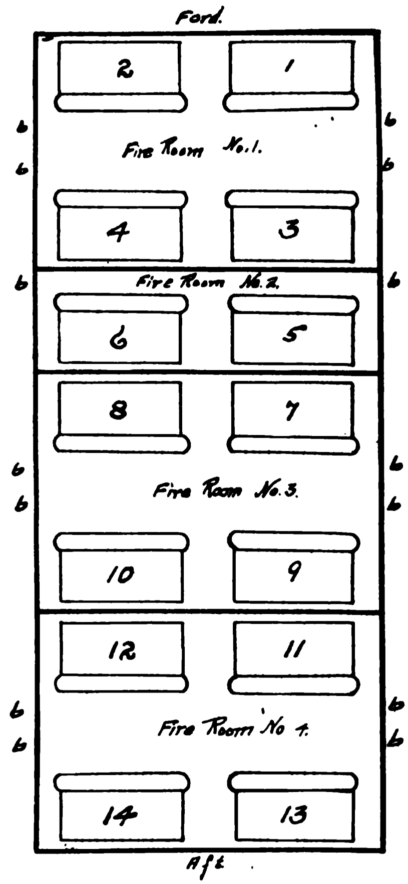
which we may represent as large W. From the grates, however, to the tops of the smoke-pipes there is also a column that has height, width and breadth, but it is not a column of air—it consists of hot gases formed by the burning of the coal on the grates, which we may represent by the letter W_g. The weight per cubic

The three principal points enumerated above were subdivided as follows:

1. To get the crew interested:
   a. Publish information.
   b. Entertain the crew—make the men happy.
   c. Rate our own men up to fill vacancies.
   d. Show the men the results of their work.
2. To systematize:
   a. Auxiliary watches.
   b. Steaming watches.
   c. Liberty and leave.
   d. Advancements in rating.
   e. Organizations:
      1. Auxiliary stations.
      2. Fire-rooms.
      3. Engine-rooms.
      4. Power and light.
      5. Fresh-water tank—galleys, washrooms and laundry.
      6. Turrets and torpedo-room.
3. To teach and encourage true economy:
   a. Calibrate all instruments.
   b. Record performances methodically.
   c. Evade nothing—analyze performances with accuracy and fairness.
   d. Teach methods of obtaining economy:
      1. By illustrated lectures.
      2. By personal supervision.
      3. By enforcing every order published.
   e. Periodical upkeep.
   f. Constant study of the machinery installation for improvement.
   g. Constant study of the rules for the engineering competitions and explaining them to the officers and men.
   h. Coaling ship.

An inspection of the fire-rooms under way disclosed that the men knew practically nothing about intelligent firing, and as the coal that would be used en route to Guantanamo would be an important percentage of the total used for the year, it became

urgent to adopt correct methods. Accordingly, colored slides were made and illustrated lectures on firing were immediately started. The system of firing taught and developed differed materially from any system in use ashore or afloat.



SKETCH No. 1.—Boiler Layout.

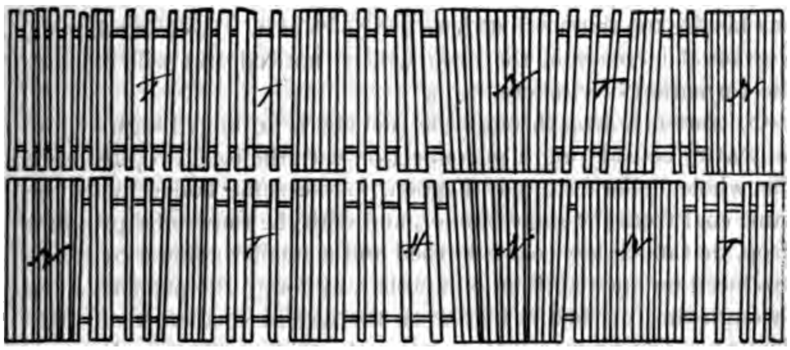
The boiler layout is shown in Sketch No. 1. All the boilers are fitted with superheaters excepting Nos. 5 and 6 in fire-room No. 2. There are four furnace doors to each boiler. The bunker doors are indicated by the small *b's*. The forced draft blowers, two for each fire-room, one port and one starboard, are directly over the fire-rooms. In order that the men would benefit from

Returning to a consideration of Sketch No. 13. In order to obtain the pressure drop through the boiler the joint was broken at the point indicated and the manometer end thrust into the uptake. The difference in the two levels was measured as so many inches. This apparatus was used to make certain that the pressure drop through the grates of all the boilers was the same; and that the resistance of the grate when there was no coal in the furnace should not be more than one-tenth of the entire drop. This was obtained by running the forced draft blowers and measuring the total boiler drop from the ash-pit to the uptake. The pressure in the uptake was greater than atmosphere, and that in the ash-pit greater than that in the uptake. The first test of the grates showed marked variations and it was necessary to take out or put in grate bars to make them all homogeneous. By making the grates the same it was then fixed that equal division of the " draft " would not be prevented by them.

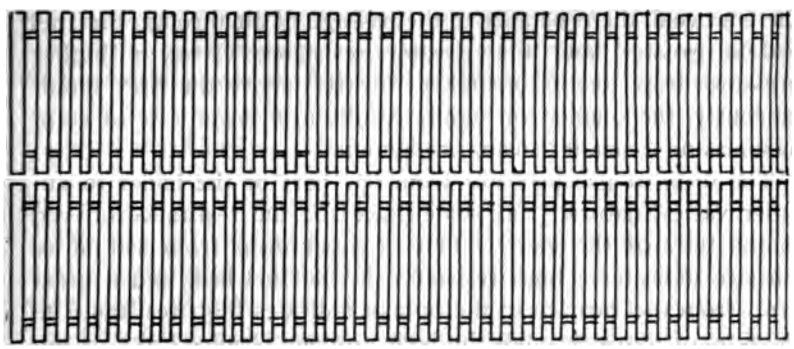
It may therefore be readily seen that after steaming, as the fires get dirty, the grates become more or less clogged and the pressure drop through the grates will increase. The amount of pressure drop through the fire bed itself is of course a variable quantity, so variable that accurate measure of it is nearly impossible. It is clear, though, that as the fires become dirty its pressure drop will increase and if the total pressure through the boiler remains constant there will be less and less available above the furnace for pushing the hot gases through the boiler and immediately the capacity of the boiler decreases. This large pressure drop now experienced through the grates and fire bed does not mean that the rate of combustion is high, on the contrary it is most likely to mean the opposite. It is common knowledge that if it is desired to increase the rate of combustion either (1) the fires must be worked more in order to break them up and lower their resistance, which is bad practice; or (2) more boilers must be cut in, which is good practice; or (3) the forced draft blowers must be run, which is good practice up to the point demanding more boilers, and then again at full power, which is the point where the boilers are producing all the steam the engines will take.

(In considering the cutting in or out of boilers versus the use of forced draft, the coal used to prime furnaces and cut in the boiler must be compared to the power consumption of the fans and in connection therewith the time element of operation must be

considered. The benefit that may be derived by having cut in a clean boiler so that later a dirty boiler may be cut out must also be given its due weight before the order to do one thing or the other is sent to the engineer officer of the watch.)



SKETCH No. 14.—Showing Irregular Placement of Grate Bars.
NNN = No air flow—no fire.
TTT = Considerable air flow—causing thin spots.
H = Extreme air flow—hole occurs.



SKETCH No. 15.—Showing Well-Placed Bars. Pressure Drop Through Grate Evenly Distributed.

The rig shown in Sketch No. 13 may also be used as a dead check on the dampers. When measuring the total boiler pressure drop, one connection being made to the uptake, have the damper closed. The two zeros should be reached gradually as the pressures equalize, if after a few minutes they do not do so, inspect the dampers. This was done on the *Texas* and two dampers were found six inches open when "closed."

The pressure (draft) gage was explained to the men and put into use when cleaning fires. Such a gage when connected to the furnace will give useful information as to the condition of the fire. For instance, after a man has cleaned a fire, if the pressure drop from ash-pit to furnace is very low, he may be sure that he has his fire too thin or that there are holes in it. With hand firing a gradual increase in the drop will be noticed and will indicate the formation of clinkers.

Of course, a drop through the fuel bed is adjudged high or low only after considering it in connection with the total drop through the whole boiler. It may happen, in the same boiler, with the same coal from the same bunker, and with the same total pressure drop, that much less coal is burned and a smaller amount of steam produced on one day than on another, although the pressure drop through the fuel bed is higher on the day of smaller steam production. The fireman may wonder why this is. The explanation may be drawn out thus: When coal is taken out of the side and bottom of a bunker, the larger pieces tend to flow out first, leaving the smaller pieces and dust in the far corners, which stay there to the last until all the coarser coal has been burned. When burning the finer coal, the resistance to the passage of air through the fuel bed is greater, and this greater resistance causes a higher pressure drop, that is, a higher "draft" above the fire; simultaneously, the smaller air supply results in a lower rate of combustion and a smaller steam production.

The drop of gas pressure from one part of the boiler to another varies, naturally, as some power of the resistance offered to the flow of the gases. Thus a great drop from ash-pit to furnace indicates a high resistance in the fuel bed, and a great drop from the furnace to the uptake indicates high resistance to the flow of gases through the boiler proper (baffles leaky or out of line). This law has been determined to be similar in some respects to Ohm's law as applied to problems involving the electrical resistance of conductors. It may be stated as follows:

(a) If the resistance to the flow of gases remains constant the pressure drop through any portion of the path of the gases will have a constant ratio to the total drop from the ash-pit to the uptake. Thus, for example, if the pressure drop through the fuel bed is 0.25 inch of water when the total drop is 0.50 inch, it will be 1 inch if the total drop is increased to 2 inches of water.

(b) If the total pressure drop from the ash-pit to uptake remains constant, the pressure drop through any portion of the gas path will vary in the same direction as does the resistance to the flow of the gases, although the magnitudes of the variations may not necessarily be in simple proportion. Suppose the total pressure drop is 0.50 inch of water and the drop through the fuel bed is 0.25 inch, if the total drop be kept constant, but the resistance through the fuel bed be increased to about 0.32 inch of water; or if, for the same total drop, the resistance of the fuel bed be increased by quadrupling the thickness, the drop through the bed will increase to about 0.40.

(c) When the resistance through any portion of the gas path remains constant the weight of gas passing through this portion varies with some power of the pressure drop through this portion. Thus, since the resistance of that portion of the gas path from over the fire bed to the uptake is generally nearly constant, the weight of gas passing through the furnace and boiler varies as some power of the pressure drop between these points. It has been determined by experiment that the weight of gases passing through the boiler is, approximately, directly proportional to the square root of the pressure drop through the boiler or through any other portion of the gas path having constant resistance.

In order to obtain economy, the "draft" must be a subject of daily discussion and study. Every officer and man on board ship must be made to understand what "draft" is and how to use it. *Ex scientia tridens.*

THE TIME-FIRING DEVICE

The use of the time-firing device was made standard for all steaming watches. Individual ideas of operation were not allowed and the rules laid down had to be followed at all times. The time-firing device and its purpose was explained to the officers and men. It was found that in order to be of real value cooperation from the bridge was necessary. Accordingly, instructions for its use were given to the deck officers and it was explained to them how they could assist. Any signals of change of speed were sent at once to the engine-room, including use of speed cones by ships ahead, and it was endeavored to anticipate speed changes if possible. The officers of the deck also kept the engine-room informed of matters of interest and the men on watch were

thus shown consideration. For instance, results of target practice, "How many hits did we get," were sent below as well as on deck.

In the use of the time-firing device the officer of the watch was required to anticipate needs for steam; for instance, if the evaporators were to be secured at 10 p.m., the time-firing interval should be increased at 9.45 p.m.

STANDING WATCH

The officer of the watch was required to spend the most of his time in fire-rooms. It was found that at least half of each hour had to be spent there in order to obtain an economical watch. He was also required to inspect the feed-water heaters twice each hour and if the temperature of the feed fell below 230° F. something had to be done; for instance, pump bilges and obtain a little more back pressure. The proper use of pumps and auxiliaries made it possible to carry a back pressure of from 26 to 35 pounds gage and a feed-water temperature of from 242° F. to 250° F.

The officer of the watch was furnished complete information of all standing orders, cut-off settings, tank capacities and as far as possible what changes he might look for during his watch.

In order to reduce the time the furnace doors were opened at each firing, operating gear was fitted to them. Firemen, third class, were detailed to work this gear and the officer of the watch marked these men as well as the other men of his watch. Each watch (every man on watch) was marked on regular scale.

OFFICE WORK

A board was hung outside the office and each day the average marks for the watches were posted. About once a week the marks of the men were posted. This board also furnished information as to the coal used by each watch, the total coal and the total water used for the day and the engineering multiple—first, for the day; second, for the month; and third, for the year to date. This multiple gained about .043 every day for six months. The board held a large E and the words "Fire light, fire often."

The performances of the other ships were posted whenever obtained.

The standing of watches was systematized and made rigid. In other words, the men were able to tell at least two weeks ahead of time when they would have auxiliary watch. The auxiliaries, such as ice machines and evaporators, were given their special details. These details were never changed and, it may be said that properly supervised, of course, they ran their own watches.

The men of the engineer's force knew that all vacancies of higher ratings would be filled on board ship. This further enhanced the values of the marks given each watch, and it was but a short while when the men fully realized it. It further increased the interest the men took in their work.

The office avoided as far as possible work out of working hours. The men were made to realize that so long as they worked during working hours their time off would not be disturbed.

Officers were on their stations during working hours, in port or at sea; and in addition to merely being around, they answered questions, they guided the men in their work, and were of genuine value. This reduced the time required to do things. In connection with cutting down time required, the telephone system was kept up and used. The senior assistant was always available and the men were made welcome in telephoning him for advice, reports or information desired. The desire to *do* things in the easiest and quickest way seemed to prevail and a real genuine "bound to win" spirit developed.

THE MATÉRIEL

Some 20 years ago, because of the fact that no great demands were made upon their efforts, the vessels of the service were small, a policy even prevailing at that time "to increase the efficiency of the service by decreasing its tonnage." In 1897, however, a decided advancement was made in the construction policy and larger ships were built and their speed brought up to 17 knots when developing 2400 I. H. P.—the *Gresham* and *Algonquin* types. Yet the ships were coal burners, their bunker capacity limited in proportion to the fuel consumption, and there was a consequent restricted cruising radius. That policy was continued until 1902, when the last comparatively fast vessel, the *Mohawk*, was launched; and from then on, owing to the greatly increased cost of construction and the practical impossibility of obtaining adequate appropriations for ships, as well as for economical reasons, the speed and even the size of the vessels have decreased. True, under the last naval appropriation bill two larger vessels were obtained, but the fatal error was made in naming $350,000 for each, while $800,000 would probably have been appropriated at that time had it have been asked for, especially when it is understood that such a sum represents the cost of the new gun boats carried on that bill. Certainly, $500,000 is the least sum that should be allotted for a coast guard vessel of the cruising type in order to properly build and equip her; and $800,000 would be the maximum for an efficient vessel, because speed is such an important factor in the cruising cutter of to-day. It is a well-known fact that by reason of construction and lack of speed, the average coast guard ship lacks the military value it should have. In this progressive age, when even rural fire apparatus is being motorized in order to develop mobility, we regard with apprehension the slow coast guard cutter, a vessel both by term and occupation presumed to be gifted with the ability to "get there." In case of war if those ships are in the zone of activities, some at least will suffer by reason of their slowness.

If sufficiently large appropriations cannot be obtained for the construction of proper vessels under coast guard appropriations, the necessity for larger and faster ships—ones having real military value as well as the ability to perform their peace duties—demands that some other means be resorted to for securing the necessary funds than has been customary in the past, in order that

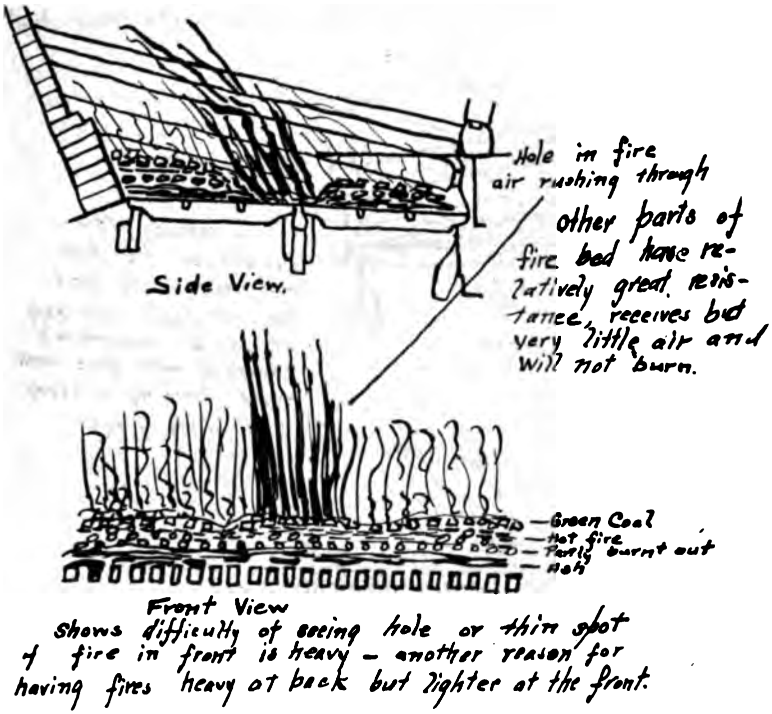
efficiency be not jeopardized. There appears to be two methods for accomplishing this: (a) The designs and specifications for coast guard vessels to originate in the Bureaus of Construction and Repair and Steam Engineering of the Navy Department, and appropriated for on the naval appropriation bills. (b) The building of a certain number of gun vessels for the naval service, and then turning a proportionate number of them over to the coast guard, fully equipped and batteried, to be used for the peace duties of that service, but ready for war duty when called on. The writer disclaims all originality for the latter suggestion, as it is understood to have been under the consideration of the naval general board. In it seems to lie the removal of a serious handicap, under which the coast guard has labored, and will continue to, for reasons here stated. It is accordingly commended to the consideration of every officer who may read this paper.

There occurs to the writer the desirability of building for the coast guard, in addition to the smaller type of vessel, about five really large ships—oil burners with ample steaming radius and with high speed. Such vessels could not only perform the function of scout cruisers, when serving as part of the navy, but would be specially adapted for the long, off-shore cruises made by cutters in search of derelicts, and on the ice patrol, etc., and they would be invaluable in case of assistance being needed by a vessel far out at sea. Such a cutter would have the ability to *go* and to keep the sea under all conditions.

The writer fully realizes that it will take money and, in some instances, special legislation to put into effect certain of the suggestions herein presented, while in others no legislation will be required. It would seem desirable that legislation be sought to give the committees on naval affairs of the respective houses jurisdiction over coast guard affairs. Where legislation is needed, immediate efforts should be made for securing the same, and there seems to be no more propitious time than the present, when the country is awakening to the necessities for national defence, to endeavor to place the coast guard, with respect to its military needs, in the same category with the army and navy, because in time of hostilities it must become a part of the latter service. The increase in the appropriation for the two last ships authorized has been denied, the bill appropriating the funds for aviation in the coast guard has been "laid on the table." Something is

NEED OF AN EVEN FUEL BED

It has been stated that a fireman must look before firing and that he must use light shovelfuls, placing his coal on the thin, bright spots. If he persists in spreading the coal evenly over the entire surface it will accumulate in heaps in places where the flow of air is obstructed, and with several firings the fire bed will look as shown in Sketch No. 4.



SKETCH No. 5.—Hole Occurring in Center of Grate.

Here we see heaps of coal, *h*, through which little or no air can flow. Coal to burn must have air flowing through it. As the fresh coal at the top of those heaps is heated the volatile combustible is distilled off and rises in columns of smoke and combustible gas, which may pass out of the furnace only half-burned. Among these heaps of coal, *h*, are shown the thin spots, *a*, through which air passes freely, causing the coal in these places, and around the edges of heaps, *h*, to burn with a bright flame. When

The extension to the coast guard of the privileges of the school of musketry at Winthrop and of those of the Aviation School at Pensacola is a step in advance. Unhappily, the former could not be utilized, because the coast guard had no money with which to send men to take the course (truly " the wolf is always scratching at the door ").

However, it is hoped that advantage will be taken of the opportunities so far presented, also that other fields for progression will be opened up; but it is realized that in this matter the coast guard must assume its share of responsibility and not neglect opportunities that are presented to it, because to do so is to neglect a responsibility thrust upon the service as a whole.

There have been presented here suggestions that would seem to point towards increasing the efficiency of the coast guard, by extending means to meet the necessities; but we must search for every method within reach to accomplish that end. Amalgamation of the coast guard with the navy has been advanced by some as one solution of the problem that confronts us. In default of that, there has been suggested that the service amalgamate with the army. It is fair to assume that conditions cannot continue as they are for long.

There is no higher honor than to hold a commission in the coast guard of the United States, a service that has never been called and found wanting, and its traditions are founded on a history, the like of which any service might well be proud. Any suggestion for amalgamation, either with the army or navy, has for its object a single purpose—the increase of military efficiency for war.

The personnel has no " axe to grind " by amalgamation with either branch of the other military forces. Should an amalgamation eventuate in the future, it must be with the navy, rather than with the army. Opposition to amalgamation will undoubtedly come and on both sides and for reasons that, it is not necessary to mention, both services know; but it is to be regretted that opposition from any source should arise to oppose an amalgamation, whether it be as a separate corps or otherwise, because it is only by so doing that the coast guard can ever hope to reach that full degree of efficiency that is not only demanded of it, but that it deserves to have placed within its reach.

The hope of personal gain, service, jealousies, if present, reluctance towards losing a service once possessed, all should be

cast aside for the one objective towards which we strive—the efficiency of the coast guard as a fighting unit. In this the navy should be vitally interested.

A military service that operates under the Navy Department in time of military emergency should operate under that department in time of peace, and to deny that statement is to disregard military efficiency. The truth is so obvious as to preclude any need for discussion and it only remains to be said that if the coast guard would not be as efficient under the Navy Department as under the Treasury Department, and if it would not continue to become more so, then the service would be a signal failure from every viewpoint.

The writer personally favors the separate corps suggestion, because the personnel would remain intact and would bring to the navy quite as efficient a corps, within the scope of its endeavors, as the navy now enjoys in that superb body—the United States Marine Corps—which always has, and always will, shed a luster upon the department under which it operates.

The navy is a conservative service and the coast guard may be regarded as being ultraconservative; therefore, there should be a "getting together" for a meeting of the minds, to the end that each personnel may know the other.

Whether the coast guard will gain in the future the place due to it will, above all, depend on whether the personnel will resolve with open eyes to break with ideas of the past and devote itself to the tasks of the present without reserve, in all of which it must have the cordial and substantial support of the navy, which, in the belief of the writer, will be heartily accorded, whether the coast guard amalgamates with the navy or not, because the necessity for co-ordination will be realized.

The events of the immediate future can only be conjectured. Grave responsibilities may eventuate at any time and come when least expected.

The coast guard is proud of its personnel and knows that if given the opportunity it will prove its worth and mettle, because there are potentialities therein that are unknown to the outsider. The point is, when the hour for action strikes, will there be co-ordination or a lack of it, and if the latter, to whom, or to what group, will the responsibility be charged?

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Membership

Life, regular and associate membership, 5784. New members: 119. Resignations: 98.

Deaths:

Commander E. G. Blackeslee, U. S. N.
Ensign A. W. Lancashire, U. S. N. R. F.
A. Paymaster B. L. Steele, U. S. N. R. F.
Mr. William L. Oliver.

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The annual dues ($2.50) for the year 1919 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

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Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 10th of each month.

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The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article

is submitted. Twenty copies of reprints are furnished authors free of charge.

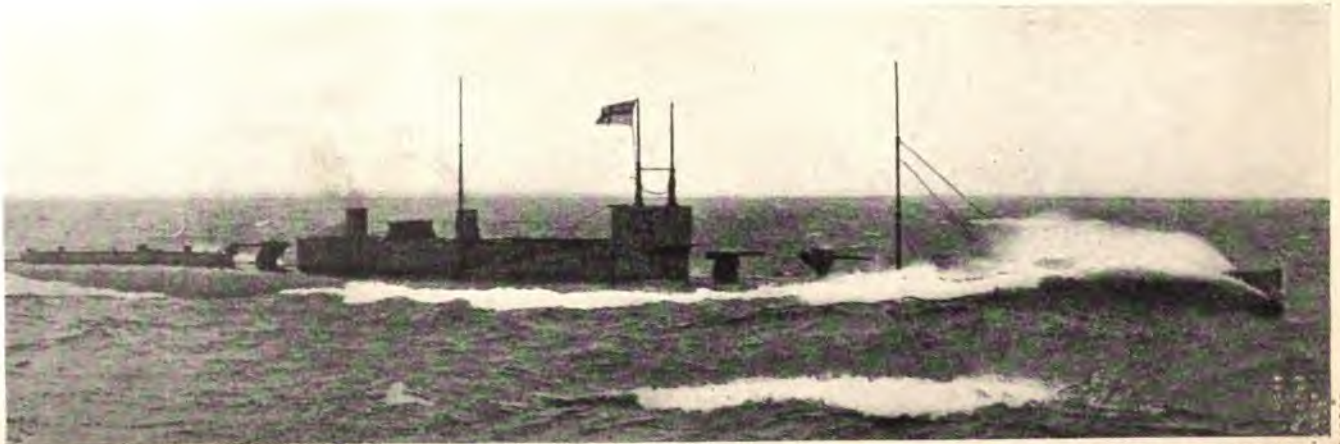
Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS (March, 1913, June, 1913, September, 1913, January-February, 1914, January-February, 1915, and November-December, 1916, January, 1918) are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 25 cents per copy.

ANNAPOLIS, MD., MARCH 15, 1919.

INFORMATION INDEX



New Type of Submarine 340 Feet in Length Doing 24 Knots Under Steam. Note the Three 4-Inch Guns, Two Forward and One Aft; Also the Two Smokestacks, Which Fold Down When the Submarine Submerges. Displacement Submerged 2700 Tons, Speed 10 Knots.

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

AUSTRO-HUNGARY

AUSTRO-HUNGARY'S DIMINISHED MERCHANT FLEET.—At the outbreak of the war Austria possessed 186 ocean-going ships, aggregating 757,043 gross tons. In addition, there were under the Austrian flag 25 vessels employed in short sea trips and 163 miscellaneous craft engaged in the coastwise trade, making a total of 374 vessels with an aggregate tonnage of 812,343 gross tons.

Of the just enumerated merchant tonnage 156,113 tons was captured, 113,053 tons sold to foreign owners, and 46,164 tons sunk by enemy action during the course of the war. The aggregate loss amounted to 315,330 tons. New ocean-going tonnage constructed in the same period amounted to 63,344 tons. When hostilities closed, therefore, Austria's merchant fleet had diminished to 296 ships of a gross tonnage of 560,357 tons.

In the case of Hungary the country had on August 1, 1914, only 69 ocean-going ships of 211,621 gross tons, 42 short sea-going vessels of 3690 tons and 62 coasting craft of 18,411 tons, or a total of 173 ships of 233,722 tons. While hostilities lasted ocean-going vessels of 51,391 gross tons were captured and vessels of 7049 tons sunk through enemy action. Seven ocean-going ships of 25,289 tons were sold to foreigners. From this total tonnage of 83,729 tons lost, there should be deducted 6152 new tonnage constructed. At the date of the signing of the armistice Hungary's merchant fleet consisted of only 109 ships of 156,145 tons.—*Nautical Gazette*, 8/3.

FRANCE

FRENCH DESTROYER DAMAGED.—Paris, Jan. 7.—The French destroyer *Enseigne Henry* was damaged in the Black Sea on the morning of January 1 as the result of a mine explosion. She was able to reach Constantinople under her own steam. Four seamen were killed by the explosion.—*London Times*, 8/1.

FRENCH NAVAL LOSSES IN THE WAR.—A full list of the French naval losses in the war, which has been published, includes four battleships, the *Bouvet, Suffren, Gaulois* and *Danton;* four armed cruisers, the *Leon Gambetta, Amiral Charner, Cleber* and *Dupetit Thouars,* and one fast cruiser, the *Chateau Renault.* There were, besides, fourteen destroyers, eight torpedo boats and fourteen submarines lost. One of the submarines, the *Duric,* was refloated by the enemy, but was subsequently recovered. The minor ships which were sunk were five auxiliary cruisers, four gunboats, 72 submarine chasers, one sloop and seven small craft.

The loss in tonnage was 110,000 tons, against 550,000 tons for England, 76,000 tons for Italy, and 17,500 tons for the United States.—*Nautical Gazette.*

WALSER'S HYDROPHONE.—The fundamental fact upon which Lieutenant Walser built is that sound, like light, is refracted on passing from one medium into another. We are accustomed to diagrams which assume that the complex of light from a given object consists of a number of component waves, which may be taken to be parallel if their source is sufficiently remote, which remain parallel so long as no obstruction is interposed in their path, and which are bent as soon as they are called upon to enter a medium of different density from that in which they were propagated. And it is just so with sound waves.

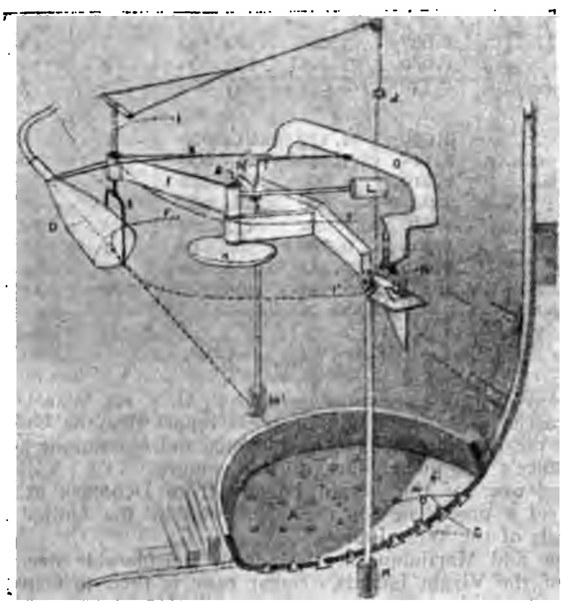
Walser therefore interposed, in the path of sound waves, a sort of acoustic lens. Just as in the case of light, this causes the individual waves which make up the sound complex from a given source to come to a focus, with the double effect of strengthening them and isolating them from the sounds that proceed from other sources. In fact, the several sources of sound give rise to as many foci, of which the geometric locus can be determined by calculation; and in the same way, from the position of the sound focus which pertains to any particular source of sound, the position—or at least the direction—of that source can be calculated.

Once this general idea had been formulated, it remained for the lieutenant to work out the practical details. As finally adopted and used with huge success in the detection of submarines, the acoustic lens was in the form of a spherical segment *A,* set into the side of the chaser or destroyer. In the bulging surface of this are a series of circular holes *B,* each filled with a sensitive vibrating plate *C.* The effect is to focus all sounds received; and the focal points all lie on a circle *I,* whose position, of course, depends upon the radius of the lens segment and other factors which can be controlled. There are two of these lenses on each vessel, one to port and one to starboard. The two give upon a single cabin, which of course extends the entire width of the ship, and is well insulated against sounds at all points save the two lenses. The observer is seated in the center of the cabin, with a listening helmet to which are attached two ear-trumpets, of which only one is shown at *D* in our diagram. One trumpet, of course, pertains to the port lens and one to the starboard.

The trumpet *D* is carried on a fork *E,* which is moved from the wheel *H* through the arm *F* and pivot *G.* The wheel *H* is connected with the rotating drum that appears in the general view; and the mechanism is so adjusted that as the operator turns the handle of this drum, the two trumpets revolve about the respective focal circles of the sounds received.

The counterweight *J* and cord *K* hold the trumpet in a position where its axis is constantly directed toward the center of the spherical lens. The counterweight *L* maintains the equilibrium of the mobile arm *F.* The counterweights *M, M',* cause this arm to oscillate about the pivots *N, N',* in such manner as to counterbalance the effect of the ship's pitching and keep the mouth of the trumpet always in the same horizontal plane. The entire apparatus is supported by the frame *O.*

In using the apparatus, the observer can hear a given sound, not only when the trumpet is precisely centered at the focal point of that sound, but when it is anywhere in the neighborhood of that point. He hears it loudest and clearest, however, when the axis of the trumpet passes through the focus, so that the trumpet is centered about the focus. He explores the field by keeping the trumpet continually in motion; and he locates every suspicious sound by carefully bringing the trumpet to the position where it is loudest and clearest. The instrument has been previously calibrated, so that when he succeeds in getting the maximum intensity for a given sound, he reads the direction of its origin on the scale that runs



WORKING PARTS OF THE HYDROPHONE.

about the edge of the drum. The distance is then estimated roughly by taking account of the intensity of the sound at its maximum; and it is then easy to steer a straight course for the source—and, if the latter be a submarine, to pass directly over it with mathematical accuracy and drop sudden death upon it.

The first successful experiments with a more or less definite model were made on March 31, 1917. After that, progress was slow, both in the way of removing the last technical obstacles, and in the more difficult business of convincing the "appropriate authorities" that here was something good. All these difficulties were surmounted, however; the apparatus was installed, and on March 16, 1918, it received its baptism of fire. Its success was immediate; and from that date to the end of the war it made a very large contribution to the nullification of the submarine menace.—*Scientific American*, 8/3.

There have been many accounts written of the work done by the French naval pilots on various occasions, but never has there appeared a comprehensive "resumé" of their achievements. For this reason, the following table which we are able to reproduce through the courtesy of the French Ministry of Marine, is of especial interest:

ACTIVITY OF THE SEAPLANES, OCTOBER, 1917–AUGUST, 1918

Month	Number of Flights made	Hours of Flight	Distance covered (miles)	Sub-marines sighted	Sub-marines attacked	Mines dis-covered
1917						
October	1,667	3,094	184,730	7	6	..
November	1,680	3,265	191,000	15	12	..
December	1,730	2,671	147,000	7	7	..
1918						
January	2,236	4,139	214,870	7	6	3
February	2,115	3,690	215,000	8	6	4
March	2,210	4,099	237,410	5	7	8
April	2,647	4,808	284,920	11	8	8
May	3,510	7,652	437,200	22	22	10
June	3,365	6,758	387,940	9	11	9
July	3,959	7,432	432,000	19	14	12
August	4,268	8,594	495,700	20	12	6

—*Scientific American*, 8/3.

FRANCE MAY CEDE WEST INDIES ISLANDS TO U. S. FOR WAR DEBT.—Confirmation was lacking of the London press report that the United States is to receive the French islands of Guadeloupe and Martinique as part payment of France's war indebtedness to this country.

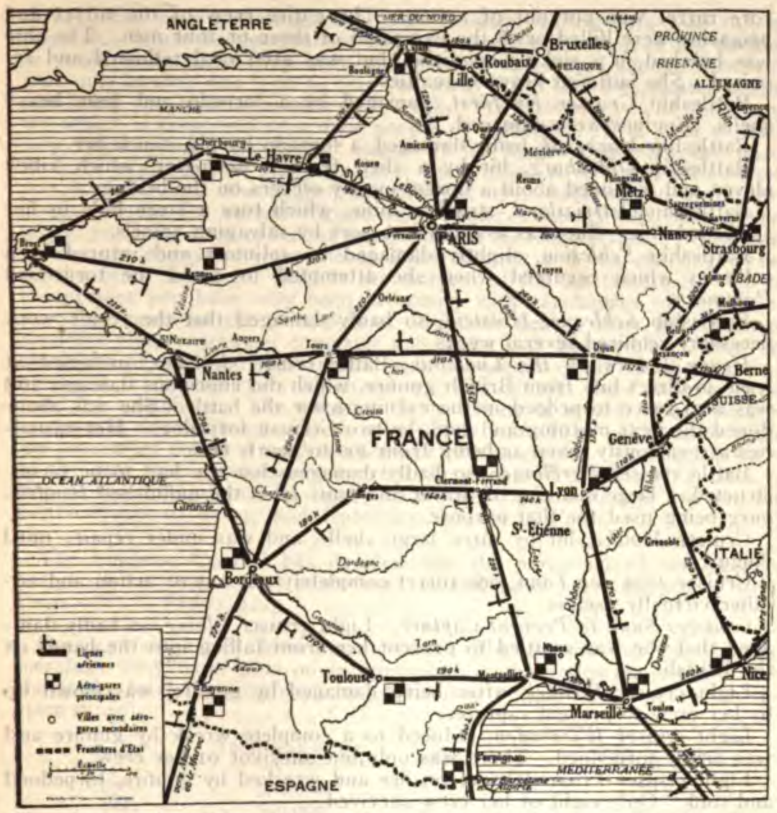
The taking over of the Virgin Islands from Denmark at a cost of $25,000,000 set a precedent for the acquisition by the United States of title to islands of the West Indies.

Guadeloupe and Martinique are islands of considerable size, lying east and south of the Virgin Islands. Sugar cane is their principal product. Considerable quantities of cocoa, coffee and cotton also are produced on both islands.

The suggestion regarding Guadeloupe and Martinique appears to be taken seriously. It was pointed out that the cost price of the two islands would not make more than a small dent in the financial obligations of France to the United States.

Naval experts were not particularly enthusiastic when their attention was called to the London report, saying Guadeloupe and Martinique would be of little value to the United States. Each island has a fairly good port, but neither is equal to the port of Charlotte Amalie in the Virgin Islands.

The ceding of Martinique and Guadeloupe would leave as the only French possession in the western hemisphere French Guiana. If that were included it would mark the first foothold of the United States on the South American mainland. This would naturally disturb the South American republics, and as the policy of this country is to calm apprehension in that part of the world, the idea makes no hit with American diplomats.—*Baltimore Sun*, 10/3.



COMPREHENSIBLE PLAN OF THE PROPOSED FRENCH AERIAL MAIL ROUTES, PREPARED BY THE CHIEF OF THE FRENCH AERIAL MAIL SERVICE.

GERMANY

SHOW 260 SHIPS IN JUTLAND BATTLE.—*German Vessels Riddled—Berlin Statement of 3076 Loss in Personnel Appears to be Confirmed.*—London, Feb. 21.—There is no reason to doubt the substantial accuracy of the German official account of the losses suffered by the German fleet in the Jutland naval battle, May 31, 1916, it is learned officially by Reuters. The German figures published June 16, 1916, showed that the casualties to the fleet's personnel were: Officers: killed or missing, 172; wounded, 41; other ratings, killed or missing, 2414; wounded, 440. Total, 3076.

Official details of damage done to individual vessels follow:

Battleship *Koenig*, struck about fifteen times and badly damaged. The ship went down by the head until her forecastle was only six and a half feet above water. The crew of the forward torpedo tube was imprisoned until the ship was placed in dry dock on June 5. Four fires were started on the ship and Admiral Hehnke was wounded in the head. The casualties on board were heavy.

Seydlitz Struck by 28 Shells.—Cruiser *Seydlitz* hit by 28 shells and one torpedo from a British destroyer. Her forecastle was riddled and her

fore turret was put out of action. The entire crew of the turret and magazine were killed, with the exception of three or four men. The ship was beached in a sinking condition, but was afterward refloated and repaired. She suffered heavy casualties.

Battleship *Grosser Kurfürst*, damaged by a torpedo and four heavy shells. Engines were damaged.

Battleship *Markgraf*, badly damaged, a torpedo having struck her.

Battleship *Oldenburg*, hit by a shell from a destroyer, which killed eleven and wounded about a dozen, mostly officers on the bridge.

Battleship *Ostfriesland*, struck a mine, which tore a large hole in her starboard side. She was assisted into port by salvaging vessels.

Battleship *Schlesien*, slightly damaged by splinters and injured in a collision which occurred when she attempted to avoid the torpedoed *Pommern*.

Battleship *Schleswig-Holstein*, so badly damaged that the repair work necessary required several weeks.

Heavy Losses on the Luetzow.—Battle cruiser *Lützow*, sustained at least 40 direct hits from British gunfire, which did enormous damage, and was also twice torpedoed in the evening after the battle. She was abandoned the next morning and sunk by two German torpedoes. Her casualties are variously given as being from 400 to nearly 600.

Battle cruiser *Derfflinger*, so badly damaged that she had to be reconstructed, a large quantity of armor and guns from the unfinished *Hindenburg* being used for that purpose.

Cruiser *Moltke*, hit by three large shells, and was under repairs until August.

Cruiser *Von der Tann*, one turret completely put out of action and another virtually useless.

Cruisers Sunk to Prevent Capture.—Light cruiser *Elbing*, so badly damaged that she was scuttled to prevent her from falling into the hands of the British.

Light cruiser *Rostock*, after being damaged by gunfire, was blown up by her crew to prevent capture.

Light cruiser *Wiesbaden*, reduced to a complete wreck by gunfire and was finally torpedoed. There was only one survivor of her crew.

Light cruiser *Frauenlob*, set on fire and wrecked by gunfire, torpedoed and sunk. Only eight of her crew survived.

Five destroyers are known to have been sunk, while others had to be towed into port.

A complete record of the British forces engaged in the battle shows 24 dreadnoughts, 8 battle cruisers, 18 cruisers, 18 light cruisers, and 78 destroyers. The German force included 21 battleships, 16 cruisers, and 77 destroyers. It is clearly established, however, that of the ships which actually came into action the preponderance of force was held by the Germans.—*N. Y. Times*.

729 KILLED AND 1,754 INJURED BY ALLIED AIR ATTACKS.—Copenhagen, March 16.—Seven hundred and twenty-nine persons were killed and 1754 injured in aerial attacks by Allied forces in German territory up to November 6, 1918, according to official figures made public in Berlin.—*Baltimore Sun*, 17/3.

THE RETURN OF THE TROOPS.—*An Address by the Commissary of the People, Haase*.—Berlin, December 12.—At the arrival of the divisions of chasseurs made up of troops from all parts of Germany, Haase, the commissary of the people, held the following address near the Brandenburg gate:

"Soldiers, the council of commissaries and the government of the socialist republic greet you in the most cordial manner. We have sympa-

thized with your sufferings and your fatigues during this war full of anguish. When the government took the power in hand, it firmly decided to avoid prolonging, even by a single hour, the stupid human butchery. Our only anxiety has been to tear you away from this complicated drama and bring you back to a successful work. We welcome you to this country which is composed of a free people of comrades. The yoke of military imperiousness no longer reigns, it no longer oppresses the unrestrained expansion of free thoughts; the former sovereigns, who forced you into war and who heaped up suffering upon suffering upon you, are down. Under the cursed régime our popular existence has been devastated; you have been called to collaborate in its resurrection. In the barracks your comrades wear the socialist insignia and the red flag waves on the State buildings. Red is the emblem of human fraternity. Up to the present you have only been presented with caricatures of socialism: a society based on the principles of socialism has no other aims than to suppress rivalry between countries and make war impossible. After the teachings of this war who would want to again excite brother against brother? From the ruins which the war has caused, there arises a great task for socialism. The question is to create a world where neither oppression nor suffering will be seen. It is your duty, soldiers, to make the movement follow a successful course rich in results. The dark powers of the past should nevermore prevent the efforts of the laboring class to rise to the level of human dignity. Our most ardent desires are for the establishment of liberty and fraternity."—*German Press.*

The Supreme Council has decided that the personnel of the German fleet is to be restricted to 15,000 men, according to press dispatches from Paris.—*N. Y. Times, 12/3.*

GERMANY'S FALLEN MERCHANT FLEET.—The growth of the German merchant fleet from 1800 on is illustrated in the following table, which shows the total carrying capacity of German vessels in the years hereinafter named:

Year	Total deadweight tonnage	Steam tonnage	Sailing vessel tonnage
1800	570,000	....	570,000
1825	300,000	....	300,000
1850	750,000	10,000	740,000
1875	1,650,000	333,000	1,317,000
1890	2,020,000	965,000	1,055 000
1910	5,870,000	5,105,000	765,000

Even more striking than the increase in the country's shipping has been the gain in the value of Germany's foreign trade. From 1830, or when comparative statistics first became available, the total foreign trade of the territory embraced in the former German Empire has been estimated as follows in millions of marks:

Year	Total trade	Marks per capita
1830	740	25
1840	1,320	41
1850	2,100	60
1860	3,200	84
1870	4,240	106
1880	5,820	128.9
1890	7,782.5	156.5
1900	10,795.6	191.5
1910	16,408.8	252.9
1913	20,866.8	

The remarkable expansion of Germany's foreign trade after the formation of the Empire is further brought out in the next table which shows both the quantity and the values of the goods exported and imported in the years named:

IMPORTS

Year	Weight in thousands of tons	Per head	Value in millions of marks	Marks per head
1872	13,325	0.32	3,464.6	83.7
1910	62,995.2	0.97	8,934.1	137.7

EXPORTS

Year	Weight in thousands of tons	Per head	Value in millions of marks	Marks per head
1872	10,049.7	0.24	2,492.2	60.2
1910	48,765.3	0.75	7,474.7	115.2

Coincident with the growth of the country's foreign trade, Germany's merchant fleet nearly doubled in size between 1836 and 1849. Imports increased faster than exports. In 1847, the Hamburg-American line was started with a capital of 300,000 marks. Its first vessels were sailing ships, the pioneer unit being the *Deutschland* of 717 tons which carried 220 passengers. The same year witnessed the departure of the first steamer from New York to Bremen. This vessel named *Washington* flew the American flag and, together with its sister ship *President,* was owned by a syndicate styled the Ocean Steamship Navigation Company, which had been formed by the State of Bremen, some neighboring German states, and certain prominent Germans in New York. This company was the first to establish regular steamship communication between the continent of Europe and the United States. Thanks to the large immigration to America, these paddle-wheel steamers proved profitable for a time. When the United States Government failed to renew its subsidy, however, the company went into bankruptcy in 1857. The North German Lloyd Company was thereupon formed to take its place.

Previous to the repeal of the British Navigation Act in 1849, colonial products like cotton and sugar were imported mostly by way of Great Britain. After the last-named year, however, these articles could be brought to Germany direct, which resulted in an increase of German overseas trade. About this time iron ships were first built. German shipping interests established lines of coastal steamers from Lübeck to Copenhagen and Petrograd and from Hamburg to Hull and London. The first German ocean going steamer, the *Helene Slomann,* was dispatched from Hamburg to New York in 1850, but was unfortunately lost on her third voyage with all on board.

Following the discovery of gold in California, in 1849, ships sailed from Hamburg to California laden with gold-seekers. As no return freight was to be had along the American Pacific Coast, these ships crossed over to Asia in search of return cargoes. Whereas only ten Hamburg ships put into the port of Hongkong in 1850 with a total carrying capacity of 4500 tons, 315 such ships with a carrying capacity of 94,000 tons entered the same port in 1864.

From 1870 on, the number of German sailing vessels began to decline. In 1877 Rostock had 356 sailers of 100,000 gross tons. By 1903, this same fleet had shrunk to 28 vessels of 17,000 gross tons, only eight of which were sailing vessels. Papenburg on the Ems, Germany's only catholic seaport, possessed in 1869 190 sailing vessels. This number had declined to 23 in 1900 and just prior to the outbreak of the war one solitary sailing vessel constituted Papenburg's entire merchant fleet. Of the 990 barks belonging to the German merchant fleet in 1876 only 23 remained when the war broke out. As to the 643 brigs in existence in 1876, not one remains to-day. Between 1875 and 1895, German merchant ships diminished from 4800 to 3600.

Elsewhere will be found an account of the rise and progress of the Hamburg-American and North German Lloyd lines. Next in importance to these great German shipping combinations is the Hamburg-South American line which was founded in 1871. The next year the Kosmos line was started to the west coast of South America. 1882 witnessed the commencement of the Woermann line service to Africa. Six years later came the German Australian Steamship Line to be followed in 1890 by the German East African Company.

At the outbreak of the war, Hamburg and Bremen were the home ports of 85 per cent of all German merchant tonnage. While half the world's merchant shipping was owned by liner companies in 1914, four-fifths of Germany's merchant shipping was thus controlled. As admitted by Lord Inverclyde, Germany was Great Britain's greatest rival from the liner point of view before the war. The German companies were showing great enterprise in the construction of large, fast, and luxurious liners when the war broke out. These vessels were, if anything, more sumptuously equipped and fitted with modern appliances, etc., than corresponding British liners in the same trades.

On June 30, 1914, the tonnage of the various German liner fleets was reported as follows:

Company	Gross tons
Hamburg-American Line	1,093,000
North German Lloyd	716,000
Hamburg-South Amer. Line	268,000
Hansa Line	339,000
German Australian Line	264,000
Kosmos Line	179,000
Roland Line	75,000
German East Africa Line	105,000
Woermann Line	112,000
Hamburg-Bremen-Africa Line	43,000
Total	3,194,000

Whether German Shipping will recover from its war losses and again become an important factor in the carrying trade of the world is as yet problematical. Its future is entirely dependent on what will take place at the Peace Conference. If Germany is stripped of her shipping and her vessels excluded from the high seas as proposed in certain quarters, very few ships will be found afloat hereafter flying the German flag. In that event, German shipowners will in all likelihood place their ships under a neutral flag.—*Nautical Gazette*, 15/2.

GREAT BRITAIN

BRITISH NAVAL ESTIMATES.—The British naval estimates, issued tonight, provide for a personnel of 280,000 and a total expenditure for the year of £149,200,000. This sum includes £68,000,000 for ship building, repairs, and maintenance.—*N. Y. Times*, 8/3.

STEAM SUBMARINES.—"The 4th August, 1916, saw the commissioning of a boat which was a revolution in submarine design. This was the first K-boat. This class was designed for the expected fleet action: their qualities were to be—that they should have several knots in hand over the speed of the battle fleet, that they should be seaworthy and able to cruise with the fleet, and that they should have the necessary submarine qualities to enable them to deal with the high sea fleet when it should be met. These qualities they have; but it is regretted that the enemy gave them no chance of trying their luck in action. They were used on patrol during the long wait for their

"Day," and their experiences on patrol and when at sea on the periodic occasions when the fleet went hurrying out in reply to reported enemy activity, have given invaluable data for future construction of large and fast submarines. These boats are of 1880 tons (surface) and 2550 tons (submerged) displacement. They have a speed of slightly over 24 knots on the surface, can carry a good gun-battery if required, and their hulls, being low and well stream-lined, and their torpedo armament powerful, they can act both as destroyers by night or as submarines by day. These boats have a battery capacity sufficient for a day's fleet battle, but no more. They may be described as having great strategic speed and capacity, but small tactical radius; that is, they can get to the place where they are wanted quickly, but are circumscribed in their capabilities of remaining submerged in that spot for long, or of moving fast submerged for more than one attack without rising to recharge their batteries. In submarine design as well as in that of surface ships, you can't have everything; each type is a compromise."

The foregoing description omits to mention one of the most interesting features of the "K" class, viz., the installation of steam machinery for surface propulsion in place of the internal combustion engines fitted to all previous British submarines. Beyond the fact that geared turbines are employed in conjunction with oil-fired boilers, no details of the machinery can be given, but we understand that the installation as a whole closely resembles that of a modern torpedo-boat destroyer. Auxiliary engines of the internal combustion type are fitted in order to charge the accumulators for submerged cruising. When running on the surface a "K" boat may be identified by her two small funnels, which are folded back along the superstructure before diving. Other data relating to this class are as follows, all figures being unofficial and only approximate: Length about 330 feet, beam 33½ feet, draft 20 feet, armament eight torpedo tubes, of which four are on the beam; four medium quick-firing guns, including two on high angle mounts for use against aircraft. In this class of boat the living quarters leave nothing to be desired from the points of view of comfort, convenience, and health. The commanding officer has his own cabin, there is quite a roomy ward-room for the officers, and there are separate messes for the petty officers, engine-room artificers and seamen. As first commissioned the boats had low bows, but subsequently they were raised to improve the sea-going qualities. Vessels of the "K" class have a very extensive radius of action on the surface, in which respect they are equal, if not superior, to the German "submersible cruisers." The experiment of equipping them with steam machinery was naturally condemned by Diesel enthusiasts as a retrogressive step, which, nevertheless, appears to have been justified by the behavior of these vessels on active service. It is interesting to note that one of the most successful submarines—judged by her war record, which includes two "mentions" in orders of the day—in the French Navy is the *Archimède,* which is also propelled on the surface by steam, her plant consisting of two sets of triple-expansion engines of 1700 indicated horsepower. It is generally understood that about 22 K-boats have been built, though the actual total may be larger.—*The Engineer,* 21/2.

"BLISTERS."—The following notes on the "blister" protection fitted to vessels of the British Navy may be of interest. In its earliest form this system was first applied to four old cruisers, *Edgar, Endymion, Thesus,* and *Grafton.* Curiously enough, more than two years elapsed before a ship so fitted was attacked by hostile submarines, and it was not until June, 1917, that the efficacy of the "blister" was tested. In that month the *Grafton* was torpedoed squarely amidships. A large hole was blown in the bulge, but the ship herself was practically undamaged. On subsequent occasions several of the monitors were torpedoed, but in no case with fatal, or even with serious results. Recognizing the futility

of torpedoes against these vessels, the Germans evolved a new weapon, from which they expected better results. This was the electrically-controlled moon-boat, the advent of which was duly reported in an official communiqué during 1917. Capable of very high speed, loaded with a heavy charge of explosives, and under perfect control from a shore station, this novel instrument threatened to become more formidable than the conventional torpedo. One of them struck the *Erebus,* demolishing part of the "blister." An examination showed, however, that the injury was less serious than had been feared, and the *Erebus* was soon in service again. After this experience all the monitors were fitted with a strong guard rail running round the bulge, and thereafter the electric boat "torpedoes" appear to have been less dangerous.—*The Engineer,* 14/2.

U-BOATS SOLD FOR JUNK.—*Purchasers of 47, Held by British Promise to Break Them Up.*—A number of German submarines lying in a British port are to be handed over to the Allied governments, some being sent to Italy, Japan, and other countries. Forty-seven submarines, of all sizes, up to the big ocean-going submarines, have been sold under the condition that they be broken up. The Admiralty will first remove their engines.—*N. Y. Times,* 5/3.

GERMAN ANTI-AIRCRAFT DEFENCES.—Now that the cessation of hostilities against the Central Powers permits the issue of sundry details concerning the work of the Royal Air Force against the German defences in Belgium the public will be able to realize better than during the actual course of the war the tremendous opposition which our airmen had to face in the performance of their duties. During the war no less than 30,000 bombs were dropped by our Dunkerque squadron—principally upon Ostende, Bruges, and Zeebrugge, which were the bases of the German destroyer flotillas operating off the Belgian coast, and contained their submarine depots, and all our aerial operations against this coastal sector were carried out in the teeth of a powerful and carefully-organized system of anti-aircraft defences. The number of anti-aircraft batteries was very large and included some guns of 8-inch caliber. One well-known gun at Westende could throw a shell up to 22,000 feet, and the local defences, both fixed and mobile, were formidable to a degree. To take one example of a closely defended locality, there were concentrated at Bruges alone within a small radius more than 50 powerful searchlights, over 50 guns of various calibers, about 40 kite balloons carrying nets, and innumerable machine-guns and tracer pom-pom guns. Yet, in spite of the intensive barrage which the enemy could put up, Bruges was on one occasion bombed from a height of only 200 feet.—*Army and Navy Gazette,* 8/2.

SHIFTS ON GERMAN FLEET.—*Britain May Let France and Italy Have Some Ships, but Sink Her Own.*—A change in the attitude of the British Government regarding the plan to sink interned German warships has been noticed since the return of Premier Lloyd George to Paris. It now appears likely that instead of the German craft being sunk Great Britain will be willing to permit France and Italy to keep some of the ships, but will consent to sink her own allotment.

In this way, it is said, Great Britain would relieve the United States of the necessity of carrying out her projected great naval building program, which, it is understood, was based on the intention of preventing any one nation from having such a predominant navy as would give her control of the seas against the powers of the League of Nations.

The addition of some of the German warships to the French and Italian navies would not sensibly disturb the balance of naval power, excluding Austria and Germany.

The desire of American naval experts that the German ships shall be eliminated, it is said, is based on considerations of economy, as they hold

that if the German ships are given to Great Britain in the proportion proposed the United States would be compelled to spend $1,000,000,000 to maintain her place in the naval lists.—*N. Y. Times*, 11/3.

AERONAUTICS.—Although the government still finds it necessary to place a ban on civilian flying, several more or less unofficial performances during the past month are worthy of note. Of them one of the more technically interesting was the ascent on the 2d of a British machine from a point near Ipswich with the pilot, Captain Lang, R. A. F., and an observer, Lieutenant Blowes, to a height of 30,500 feet, thus establishing a world's altitude record for an aeroplane. The machine used was a DeHavilland 9 biplane, made by the Aircraft Manufacturing Company, and equipped with a Napier "Lion" engine developing 450 horsepower. The first 10,000 feet was accomplished in 6 minutes 18 seconds, the first 20,000 feet in 19 minutes 40 seconds, and the maximum of 30,500 feet in 66 minutes 55 seconds. The oxygen apparatus and the electrical heating apparatus both gave trouble, and at the maximum height the engine stopped running by reason, it is stated, of the failure of the small propeller-driven petrol and oil pumps. The feat was accomplished, it is interesting to note, in a wind blowing, on the ground, at 35 miles an hour. Another notable performance was the flight on the 18th of a large Handley-Page machine from Belfast to Sheffield, and thence at a later date to the east coast of England. The machine was fitted with four Rolls-Royce engines, developing a total of 1600 horsepower, and was built by Messrs. Harland and Wolff. It was one of a number constructed for the bombing of Berlin, and was of the same design as the machine which in November flew over London with forty passengers on board. Fully loaded it weighs over fourteen tons, and carries sufficient fuel for a flight of 1500 miles. On the journey from Belfast the machine carried a crew of seven with half a ton of luggage, the pilot being Mr. C. B. Prodger, the well-known aviator. The weather was bitterly cold and windy at the start, and later, especially over the Midlands, heavy banks of fog were encountered. The journey was made via the Isle of Man, Blackpool, Preston, and Manchester, and was commenced a few minutes after noon. At 3.25 p. m. the pilot brought the machine to land at Sheffield, having spent 25 minutes in the endeavor to find the aerodrome. The journey of 300 miles was thus accomplished at the rate of 100 miles an hour. During much of the course the ground was invisible and the pilot had to steer by his compass. Bad weather prevented the continuation of the journey to the east coast for some days—it had been intended to accomplish the whole trip in one stage—but eventually the remaining portion of the journey, a course of 130 miles, via Lincoln, Skegness, and the coast line southwards, was successfully achieved, in spite of gusty winds, storms and low-lying mist, the time taken being one hour forty minutes.—*The Engineer*, 7/2.

8000 GERMAN PLANES BAGGED.—*Britain Reports 2800 of Her Aircraft Were Lost*.—London, March 13.—During the war 8000 enemy airplanes were shot down by the British air forces, while 2800 British air machines were missing, Brig.-Gen. J. E. B. Seeley announced in the House of Commons to-day in introducing the army's estimates of £66,500,000. General Seeley said that if the war had continued the estimate would have been £200,000,000.

When the armistice was signed, he added, England was turning out 4000 airplanes a month and had 200 squadrons in commission compared to six at the beginning of the war.—*Baltimore Sun*, 13/3.

THE CLYDE-BUILT AIRSHIP "R.-34."—The new Clyde-built airship *R.-34*, says *The Glasgow Herald*, is expected to have a speed of 80 m. p. h. to 90 m. p. h. under average weather conditions, and to be capable of cross-

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE UNITED STATES COAST GUARD: ITS MILITARY NECESSITIES

By CAPTAIN F. S. VAN BOSKERCK, U. S. Coast Guard

FOREWORD

The following paper was prepared several months prior to the outbreak of the present war, but it has been impracticable to print it until now.

The fact has become apparent that in the past the navy and the coast guard have not gotten sufficiently close together, but it is thought that from the beneficial results attending present association, each service will have appreciated the worth of the officers of the other, to the mutual advantage of the two services and the public interests.

Since mobilization, the enlisted personnel of the coast guard has increased until it now numbers about 6000 men—2000 more than on a peace basis—and many changes have transpired as to the disposition of the entire personnel, which is now scattered among coast guard ships, naval vessels, at air stations, in Washington, and in the several naval districts, and the need for experienced officers has been urgent.

It is suggested that now is the psychological moment to make a mental survey of conditions, to take a look at them from a fair, unbiased viewpoint, and thus to realize the errors of the past, brought about as they have been by misunderstandings and a lack of knowledge of facts.

THE AUTHOR

This paper has been written with the single idea of presenting to the officers of the navy and coast guard tentative suggestions for increasing the military efficiency of the latter service, which, if adopted, would be in the best interests of the navy and the

the narrow material standards they were able to understand, overwhelmingly powerful, they assumed that the enemy would be afraid—just as they themselves were unprepared—to attack. Accordingly they did not protect the fleet bases nor prepare for thwarting the under-water war which, had their plan been right, was the only form of war in which the enemy could engage. And, having misconceived the whole nature of war, they could not, of course, select men for the chief command on any proof of their fitness for it, nor could they train or prepare them to engage in it.

When war broke out, a member of this group, whose singular personal charm, firmness of character, grasp of detail, and talent for organization, had made him by much the most effective and influential, was sent to command the fleet which was in all essentials his own creation, and to carry out the plans of which he was so largely the author.

The Testing of a Theory.—The test of the whole work of this group naturally, and inevitably, came when the chief fighting forces of the opposed sides met at the Battle of Jutland. And those who thought this group mistaken in its aims and methods, pointed out that the commander-in-chief on that occasion was true to type. They asserted that he did not bring his fleet into action as would a man who was determined to win a decisive victory as rapidly as possible; that, on the contrary, he left the fast division of the fleet unsupported at the most critical moment; that, when circumstances enabled him to retrieve the situation, rather than allow his fleet to face the risk of a torpedo attack, he turned his ships incontinently away, and so allowed Admiral Scheer to escape. On the morrow—they went on to say—no effort was made to redeem the failure of the day before.

This, briefly, is the indictment that has been brought against the Material School and Lord Jellicoe. When, therefore, it was announced that he was about to publish a volume on his command of the Grand Fleet and the Battle of Jutland, it was natural people should expect a reasoned reply to the case that had been brought against him. *The Grand Fleet*, 1914-1916 (Cassell, 31s. 6d. net), shows that this expectation was founded on a complete misjudgment of Lord Jellicoe as a man, and consequently upon a complete misconception of his object in writing.

The Grand Fleet, 1914-1916, is not a reply to the case I have set out above, nor is it a defence of the author's policy, nor, in the narrower sense of the word, is it an apology. Take the charge that the navy was unprepared. Lord Jellicoe, so far from attempting to justify either himself or those with whom he was so closely associated both in pre-war days and after, carries the indictment to lengths that no critic of the Admiralty has ever thought of in his dreams. The policy of adopting dreadnoughts had indeed been questioned; but no one had ever suspected that every single ship of this type had been built on a hopelessly wrong constructional principle, and so built to the knowledge of those who ordered the construction. We knew that the wrong place had been chosen for the fleet base, and that it was undefended against submarines and mines. But we had no conception that no provision of any kind had been made for putting it into defence for war, and that it was without the means of fitting or supplying a single ship, or of providing the most elementary facilities for the most vital of the fleet's activities, namely, gunnery practice. The degree to which we were under-supplied with light craft as compared with the enemy was almost incredible. We had a bare quarter of their provision! We were without the means of making or thwarting under-water war generally, and in a host of crucial matters—range-finders, fire control, armor-piercing shells, searchlights, and substitutes for searchlights—we were at a disadvantage that is inconceivable. The curious thing is that as to every one, almost, of these points, controversy had been active before the war, and almost everything which experience showed to be necessary had been urged, but without success, on the boards of which Lord Jellicoe

was a member. The gallant officer's category of defects is a stupefying arraignment.

The Battle of Jutland.—When we come to Jutland, the thing is more extraordinary still. He meets the charge of unwillingness to fight at decisive ranges by explaining, with almost painful precision, why it was he feared the Grand Fleet could not survive—in sufficient strength to safeguard Allied interests—if, even for a moment, it were brought into close action with the enemy. He then goes on to show how, between 6 and 6.14, he had the choice of two modes of deployment only, and, by exquisitely careful plans, he proves to demonstration that by neither method could he either bring the fleet into action or come to the support of Sir David Beatty's squadron. Then, when at last his fleet was in action, he tells us with meticulous accuracy why at 7.23—though he knew that a German Fleet in being "was the worst possible thing for us"—he turned his ships away from the enemy the moment the first of the two great torpedo attacks was made, and then how it was just this turn, and nothing else, that enabled Scheer to break off the action and escape. And finally, with the same sustained candor, he tells us how on the morning of June 1st he expected the enemy to be at a certain place and at a certain hour, how he knew the enemy's ships had been battered and damaged, and how, nevertheless, with 25 undamaged battleships against the enemy's 20 cripples, he did not attempt to intercept them and retrieve the misfortunes of the day before.

Lord Jellicoe's Attitude.—Now, if the book is not a defence, what is it? It clearly has no parallel in literature save, perhaps, amongst the arresting records bequeathed to us by the simplicity of certain singular saints and the cynicism of a few exceptional sinners. Lord Jellicoe has, in short, set himself to the extremely difficult task of self-revelation; and he has succeeded to a very extraordinary degree. He has succeeded because he is calmly conscious that he has done his duty as he understood it, and, being perfectly confident of this, he is above consideration of fear or caution in telling the truth, the whole truth, and nothing but the truth. His is an act of faith in the sense of justice of his countrymen: the work of a man too proud to fight for a reputation which he knows to be completely unindictable on any ground of morals or of honor. He is too single-minded and too simple-minded to conceal a single motive or to misrepresent a single action. He seems to say to his readers—"I give you the story as it happened: I show you my mind at work. If I am wrong, it is because I acted on wrong principles; but I am not conscious of it. I leave my character in your keeping."

It is, then, impossible to close this book without an intense sense of the magnanimity and generosity of the writer. If there is a case against him, he has given it away quite hopelessly. It is precisely because of his conviction that there is no case that makes it so hard to insist that there is. But the obligations of intellectual integrity remain, even when it would seem that there is nothing left to fight for, and nobody to fight with, for Lord Jellicoe has disconcerted his critics by the strangely effective device of disarming himself. These obligations bind, however, because while Lord Jellicoe's book shows his motives from first to last to be of the highest, and his character to be above and beyond the least possibility of disparagement, the effect of his appeal to the public must be considered. Judging from the reviews, the book is taken to justify not only the writer—which it should—but the policy and the theory of war which he represents, which it should not. It is possible that this may be only a passing mood—the natural reaction of the confiding candor of this appeal. But whether this is so or not it seems obligatory to say that if national interests are to be served a true and not a false impression must be deduced from these pages.

The paradox of the position, of course, is that Lord Jellicoe tells the same story as his critics—with a wealth of proof to which none of them

could pretend—and, at the end of it, is still serenely confident that he did the right thing. The paradox is to be explained, it seems to me, by one thing only. He is the victim of—better, perhaps, the martyr to—the basic fallacy of the materialists' creed. He simply never realized what fighting meant and, therefore, what a fleet was for. This, I think, can be illustrated by three matters on which he dwells with some insistence.

When the battle-cruiser fleet came into sight at Jutland at six o'clock, the commander-in-chief had at once to consider how to deploy his ships. The considerations that weighed with him are set out in full on pages 343 to 351. The salient point is that he felt he could not deploy at all until he knew exactly where the German Battle Fleet was. He got his first indications of the bearing of the German Battle Fleet at 6.14 and deployed at 6.16. But *Lion* had been seen at 6 o'clock by *Marlborough*, and at 6.6 by *Iron Duke*, and she and her consorts were clearly engaged with the enemy. Should it or should it not have been elementary that here was the clue to his doubts? Could he possibly have been wrong in preparing at once to deploy in support of friends who were fighting?

Fire Control at Jutland.—The second matter is this. In the diagram describing a proposed starboard deployment, Lord Jellicoe explains that this would have involved putting on large helm, which, because his fire control was unable to get data for hits in such conditions would have put all his guns out of action. Yet when he finally got into action after changing course to south at 6.50, he ordered helm six times in the 36 minutes between 7.5 and 7.41. His experience of action certainly was then that it was impossible for an admiral to keep a fleet on a steady course for even half an hour—leave alone the consequential helm involved in station keeping after each fleet order had been given. Add to this that during this half-hour a great number of individual ships in the rear of the line had had to manœuvre freely on their own to avoid the torpedoes, over 20 in number, that passed through the line, and every turn silenced his guns! If ever a man had the practical proof of a technical requirement of fire control in action, surely it was Lord Jellicoe on May 31. Yet he takes great pains to tell us that he was perfectly content with the instruments he had, and that after the action he neither ordered substitutes for the range-finders which had failed him, nor improved instruments for finding and keeping the rate under helm!

Third, we have seen that Lord Jellicoe represents that there were but two methods of deployment open to him, and he has proved that neither could have achieved any useful purpose. But he does not enumerate amongst the lessons of his experience any revision of his tactical theory.

Yet, it is a matter of plain fact that methods of fire control, designed to meet the conditions which arose at Jutland, were submitted to the Admiralty in 1912, when Lord Jellicoe was Second Sea Lord; and a method of deployment, differing from either of those to which Lord Jellicoe considered himself limited, was worked out and practiced by the Battle Fleet in one of those rare intervals when officers not of the dominant school were in command. But writing two years after the action, Lord Jellicoe still seemed to think that he could not be blamed for having no tactical resources but those which he used or rejected, and the lessons of the battle left him without any desire for a more efficient system of gunnery.

It is strange enough that he should have forgotten that there was no reason whatever why the fleet's gunnery should ever have been paralyzed in this way, except the not too creditable reason that the Admiralty in 1912 declined to spend a trifling sum per ship to remove this inability for ever. For it was in that year proved, and in a vessel afterwards under Lord Jellicoe's command at Jutland, that a ship going full speed could fire under full helm and make a succession of hits, just as if on a steady course. The reason the wiseacres of Whitehall, while fully admitting that the instruments had done all that was claimed for them and that no other

instruments had ever even aimed at surmounting these difficulties, declined to adopt them, was that they did not think any such problem as this could arise in action!

The phenomenon with which we have to deal then is not a mind that could not foresee what war would require, nor one that could not recognize those requirements when convincingly anticipated and demonstrated. It is a something much more wonderful still, a mind unable to recognize after victory in a fleet action had been thrown away, that, had an admitted defect been met by an admitted cure, the result must have been different.

The secret of our naval failure is, then, now a secret no longer. It is explained by the mental atrophy that followed from the obsession of wrong principles and too long a retention of irresponsible because uncriticized, power. Lord Jellicoe, by a magnificent gesture and with quite simple-minded courage, impelled by some power of destiny perhaps beyond his control, has told the truth about himself and his colleagues, and has ended the dynasty for ever. *The Grand Fleet,* 1914-1916, is then not only the swan song of the Materialist School, it is its suicide. Like the blind prophet of old, Lord Jellicoe has brought down the temple and all within it. One feels inclined to add that it is his friends and not his enemies whom he has slain. But this singular man has never made an enemy.

Some of us, who recognized the things described in this book for what they were, while they were being done, and even before they were done, have wearied the public and caused incredible pain to old friends in the naval service—to whom criticism of their leaders seemed almost a blasphemy. If we attacked, it was from no personal animosity, but from sheer dread of the inevitable consequences that must follow from this devastating creed in action. Lord Jellicoe's book justifies our efforts, as surely as it ends them. Henceforth, the debate on naval policy need concern itself no longer with the persons, but with principle only.—*Land and Water,* 20/2.

JAPAN

JAPANESE STRENGTH GIVEN.—A report showing the strength of the Japanese Navy was submitted by the Secretary to fill out the reports of the comparative strength of the navies of the six other large powers which he gave recently. It shows thirteen battleships and four building or projected; seven battle cruisers, ten cruisers, sixteen light cruisers and seven more building or projected, five armored coast defence vessels, sixty-six destroyers and twenty-three building or projected, sixteen first-class torpedo-boats, eight second-class torpedo-boats, fifteen submarines and twenty-seven building and projected and two airships and sixty-three miscellaneous vessels.—*Naval Monthly,* February.

JAPAN'S MERCHANT FLEET.—According to the Japanese Department of Communications Japan had, at the end of October, a mercantile marine consisting of 2546 steamships and 11,997 sailing boats. Of the steamships, 588 were ocean-going ships above 1000 tons. The total gross tonnage of these ocean-going boats was 1,801,242, their registered tonnage being 1,135,094. Of the sailing craft, ocean-going ships above 1000 tons were only two, their gross tonnage being 3438, while their registered tonnage amounted to 2233.

Steamships above 10,000 tons numbered seven, their gross tonnage being 71,899, while their registered tonnage was 38,551. The vessels between 9000 tons and 10,000 tons numbered eight, their gross tonnage being 76,043, while their registered tonnage was 48,498. There was only one vessel above 8,000 tons, its gross tonnage being 8150. The boats between 7000 and 8000 tons numbered fourteen, their gross tonnage being 105,415. Those

between 6000 and 7000 tons were 22, their gross tonnage being 140,102. Those between 5000 and 6000 tons were 45, their gross tonnage being 256,635. Those between 4000 and 5000 tons numbered 38, their gross tonnage being 171,254.—*Nautical Gazette*, 2/15.

THE PACIFIC ISLANDS

This map shows the geographical relations of the Pacific Islands to Australasia and Japan. All the islands formerly German have been occupied, either by Australasian or Japanese forces. The Japanese hold the former German islands in the Ladrones, Marshalls, and Carolines.—*London Times*, 1/31.

UNITED STATES

REPAIR SHIP AND TRANSPORT TO BE BUILT.—Secretary Daniels has signed plans for Repair Ship No. 1 and Transport No. 2, included in the 3-year program of August 29, 1916, and directed to be begun prior to July 1, 1919.

The vessels represent a modern floating plant capable of taking care of all the ordinary repairs of the vessels of the fleet, including battleships and battle cruisers. The repair plant consists of a machine shop, brass and iron

foundry, boiler and blacksmith shop, coppersmith shop, pipe and sheet metal shop, pattern shop, and carpenter shop, electrical shop, drafting room, optical shop, and gyro-testing room. The repair ship is about 484 feet long over all with a beam of 70 feet and draft of 19 feet, displacing about 10,000 tons. The battery consists of four 5-inch guns and four 3-inch anti-aircraft guns.

The transport has been designed after a careful study of the service of the present transport, *Henderson,* during the European war. It is essentially a duplicate of the *Henderson* with such changes as were considered advisable as a result of war experience; like the *Henderson* it has been designed for the purpose of transporting an expeditionary force of marines together with their advance base outfit and equipment. The principal dimensions are: Length, 484 feet; beam, 64 feet; draft, 19 feet 6 inches; displacement, about 10,000 tons. The battery will consist of four 5-inch guns, two 1 pounder guns, two 3-inch anti-aircraft guns, and two 6-pounder guns.

Both the repair ship and the transport will be propelled by the customary steam turbines, operating through reduction gearing. The vessels have been designed for a speed of 16 knots per hour. Both vessels will be equipped with high-power radio outfits.—*Naval Monthly,* March.

NAVAL POLICY

DANIELS TO CONFER ON IDEAL WARSHIP.—Secretary Daniels and a party of American naval experts will leave for Europe next week to discuss with allied officials the best type of capital warships to be built in the future, based on the lessons gained in the great war. Because of conflicting opinions on this subject among American officers the Secretary has been asked to submit a definite recommendation to the next Congress in December.

Secretary Daniels will be accompanied by Rear Admirals Taylor, Chief of the Bureau of Construction and Repair; Griffin, Chief of the Bureau of Steam Engineering; Earle, Chief of the Bureau of Ordnance, and Commander Foote, his personal aid. The party will be joined overseas by Admiral Benson, Chief of the Bureau of Operations, who is attached to the American Peace Delegation, and Vice Admiral Sims, commanding all the American naval forces in European waters.

Mr. Daniels and his party will sail from New York on the transport *Leviathan* and will go first to Paris to confer with the French Admiralty. Later they will visit London and Rome and probably will be away a month or more.

While deductions to be drawn from war experiences on all subjects will be discussed in detail, the American Naval Mission will address itself particularly to the question of future types of capital ships. It has been the judgment of the Navy General Board, charged with fixing the military characteristics of new ships, that the United States should continue to build dreadnoughts of constantly increasing power and battle cruisers. This view is held by Rear Admiral Fletcher, chairman of the General Board and former commander of the Atlantic fleet.

Admiral Mayo, now commander of the Atlantic fleet; Vice Admiral Sims and Rear Admiral Rodman, the three officers who have held the highest posts of the American service in the war zone, believe, however, that a composite ship, combining the speed of a battle cruiser with the gun power and armor of a battleship, should be substituted. These officers have been particularly impressed by British experiments toward a composite craft with the construction of the *Hood,* one of the so-called British "hush" ships.

Secretary Daniels has not taken sides in the dispute, nor have his three chief technical advisers, the men who will design and construct whatever

ships may be decided upon, expressed any opinion on it. It is the Secretary's purpose to give these officers a full opportunity to go into all of the involved technical questions as to design during the trip abroad in order that he may have the benefit of their advice when it becomes necessary for him finally to determine future ship types.

Mr. Daniels was invited by the British Admiralty to visit Europe during the war, but he was unable to accept that invitation. Assistant Secretary Roosevelt, who will be acting Secretary while Mr. Daniels is overseas, twice visited the war zone.—*N. Y. Times*, 8/3.

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, FEBRUARY 28, 1919

Type, number and name	Contractor	Per cent of completion			
		Mar. 1, 1919		Feb. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
42 Idaho	New York S. B. Co	99.7	99.7	99.1	99.1
43 Tennessee	New York Navy Yard	61.2	58.2	60.7	54.7
44 California	Mare Island Navy Yard	55.6	42.8	53.6	40.3
45 Colorado	New York S. B. Co	13.7	1.8	6.8	.4
46 Maryland	Newport News S. B. & D. D. Co	41.8	32.4	39.9	31.
47 Washington	New York S. D. Co	10.1	1.2	4.3	.4
48 West Virginia	Newport News S. B. & D. D. Co	19.1	2.2	19.	2.1
49 South Dakota	Navy Yard, New York	0.	0.	0.	0.
50	Navy Yard, New York	0.	0.	0.	0.
51 Montana	Navy Yard, Mare Island	0.	0.	0.	0.
52 North Carolina	Navy Yard, Norfolk	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co	0.	0.	0.	0.
2 Constellation	Newport News S. B. & D. D. Co	0.	0,	0.	0.
3 Saratoga	New York S. B. Co	0.	0.	0.	0.
4 Ranger	Newport S. B. & D. D. Co	0.	0.	0.	0.
5 Constitution	Phila. Navy Yard	0.	0.	0.	0.
6	Phila. Navy Yard	0.	0.	0.	0.
Scout Cruisers					
4	Todd D. D. & Const. Co	24.5	1.15	24.5	1.15
5	Todd D. D. & Const. Co	22.	1.	22.	1.
6	Todd D. D. & Const. Co	17.6	.6	17.6	.6
7	Union Iron Works	0.	0.	0.	0.
8	Union Iron Works	0.	0.	0.	0.
9	Wm. Cramp & Sons Co	9.	0.	9.	0.
10	Wm. Cramp & Sons Co	9.	0.	9.	0.
11	Wm. Cramp & Sons Co	0.	....	0.	....
12	Wm. Cramp & Sons Co	0.	....	0.	....
13	Wm. Cramp & Sons Co	0.	....	0.	....
Miscellaneous					
Fuel Ship No. 16 Brazos	Boston Navy Yard	89.	88.	87.5	86.5
Fuel Ship No. 17	Boston Navy Yard	17.8	.1	11	0.
Fuel Ship No. 18	Boston Navy Yard	.1	.1	0.	0
Gunboat No. 21	Asheville, Charleston Navy Yard	74.3	73.3	71.	70.
Gunboat No. 22	Asheville, Charleston Navy Yard	0.	0.	0.	0.
Hospital Ship No. 1	Phila. Navy Yard	25.	10.	24.	9.
Ammunition Ship No. 1	Puget Sound Navy Yard	72.	62.	66.	54.
Ammunition Ship No. 2	Puget Sound Navy Yard	18.	0.	12.5	0.

There are 206 destroyers, 73 submarines, 23 mine sweepers, 20 sea-going tugs, 40 harbor tugs, 12 oil tankers, and 53 Ford eagles in various stages of completion.

WILSON OPPOSED TO SINKING FLEET.—President Wilson is not in favor of taking the German Navy to sea and sinking it. The President has written a letter to Representative Alvin T. Fuller, a Republican member of Congress from Malden, Mass., expressing his disapproval of the reported intention of the Peace Conference to do so. On February 27 Representative Fuller took the matter up with the President in a letter in which Mr. Fuller asserted his belief that the business sense of the people at large "will be utterly opposed to the wanton destruction of a navy worth $200,000,000."

"Your letter of the 27th of February," says the President's reply to Mr. Fuller, "has interested and gratified me very much. I feel as you do about the project to sink the German ships. It seems to me like the counsel of those who do not know what else to do. But I have not yet had the opportunity to discuss it with any authoritative naval men and therefore do not like to form a final judgment about it without hearing them. I shall take it up when I get back to Paris and shall not forget that your judgment coincides with my own present conclusion. You are very generous in your personal message and I appreciate it most deeply. Your confidence on what I am trying to do gives me the most delightful reassurance."—*N. Y. Times*, 8/3.

ARGUE FOR SINKING OF GERMAN SHIPS.—President Wilson is taking up the subject of the destruction of the warships surrendered by Germany. Although an adverse judgment was recently attributed to him, this is the first time he has examined the matter, and he has called for data from American naval experts.

In addition to destroyers and submarines, there are involved 21 German and Austrian battleships, six battle cruisers, and 19 light cruisers. Among the arguments brought to bear for their destruction are the following:

It is in accord with Article VIII of the covenant committing the League of Nations to a general policy of disarmament. Destruction would demonstrate the sincerity of this committal.

Distribution would increase the armament of the allied European powers 30 per cent. The German naval menace having been removed, the increase would be absolutely unnecessary and illogical.

The addition of the German ships to the navy of any European power increases the economic burden and imperils the financial credit to the injury of the United States.

The distribution would further arouse competition and rivalry.

The United States should not participate in it. She went in with clean hands and should come out with empty ones, refusing to share in any spoils.

There would be danger of nations selling these ships to one another and thereby throwing naval power out of balance and causing distrust and friction.

The distribution will create new and artificial standards among the three powers dependent on sea power—Great Britain, America, and Japan. It is absolutely necessary that each should maintain its relative strength for itself and for the common interest of the League of Nations. America would have to bear the brunt of matching Great Britain in building. Thus the effect of distribution would not be to diminish but to increase the building competition and expense.

The argument that France during the war was compelled to manufacture munitions, while the other nations built warships, is academically sound, but France suffered no real comparative disadvantages. Germany's naval destruction removes her sea danger, and the ostensible expansion would only add to France's expense in the face of decreased financial resources.

The distribution of capital ships with the United States not participating, would work out as follows: Before the distribution Great Britain

has 43 capital ships, and all the others 42. The proportion of destroyers and submarines runs about the same. The United States must build 26 more capital ships than Great Britain in order to be on a basis of equality.

Distribution on the basis of two ships to one would give Great Britain 53 capital ships and all the others 59, and the United States would have to build 36 more to reach an equality with Great Britain.

If the distribution were made on the basis of losses suffered in the war Great Britain would have 63 and all the others 49, and America must build 46 more than the British. The distribution would compel the nations to support 112 instead of 85 capital ships.

If both America and Great Britain should refuse the German ships the distribution would be as follows: France, with seven capital ships before the distribution, would have 11 under the first method of distribution and 12 under the second; Japan, with 13 before the distribution, would have 17 by the first method and 13 by the third method of distribution; and Italy's share would be five, nine and seven respectively. Japan would thus have the same total of capital ships as America.

Summing up, the arguments are as follows:

1. In the face of the covenant committal to decreased armament, distribution makes an immediate increase of 30 per cent in allied European armaments.

2. As matters stand the American ability to put through a building program creates the possibility of inducing Great Britain to join her in the alternative of scaling down to the lowest point the number of ships consistent with self-protection and maintaining the League, whereas distribution will make new standards to be built up to.

3. Distribution will vastly and unnecessarily increase the burden of taxation.

4. World interests would be subserved by no one power controlling the seas against all comers.

5. The morale of the world requires a dramatic heralding of better days. Distribution is a step in the opposite direction.

6. Destruction preserves entire our moral position with respect to Germany.

7. American interests compel the acceptance of a joint naval burden with Great Britain. Distribution will make that burden too great for America to carry.

8. Finally if the German fleet is thrown among the Allies to be contended for as a prize. it will prove a veritable apple of discord that may make its surrender profit to Germany more than if she had risked her ships in a final battle. The division of naval spoils would be a negation of the principle of co-operation which is the foundation stone of the League.—*N. Y. Times*, 15/3.

SUPER BATTLE CRUISER IDEA FOR NEW NAVY.—Franklin D. Roosevelt, Acting Secretary of the Navy, was asked in Washington the other day if he would make a statement in language that every one could understand about the controversy now raging (with no ill-feeling, however, among our chief naval officers) as to what should be the dominant type of ship in our new program for a navy equal to any in the world.

What he said showed that the issue had been gathering for a year, though it did not culminate in any step known to the public until Secretary Daniels recently announced that, pending a decision as to the future type, work on the six new battle cruisers would be discontinued, and that he, accompanied by his three chief technical advisers, would visit the Navy Departments of England, France, and Italy and study at first hand the naval lessons of the war.

From reports sent out of Washington the inference would be that the main purpose of the visit to Europe was to adapt or be guided by the latest naval activities over there. The case appears somewhat different. If the idea on which the division now exists is adopted by our navy, we would lead the way for the world in a type of ship as destructive in its character as the first dreadnought. In the words of Secretary Roosevelt, who weighs the pros and cons in the light of naval experience in the war, it would be "a tremendous departure."

Up to this time the line of development in our navy, and in all navies, more or less, has been to push forward two distinct types of heavy ships, the cruiser and the battleship. Each has been made more and more formidable in its special characteristics. Here, on the next step, is where the division of opinion takes place in our navy. This is the contention of one body of the experts:

Fuse the two types into a ship as nearly as possible to the power of the dreadnought and to the speed of the battle cruiser—itself, to be sure, as its name implies, a British experiment in the same direction. Vice Admiral William S. Sims. who commanded our naval forces in Europe during the war; Admiral Henry T. Mayo, commander-in-chief of the United States Atlantic fleet, and Admiral William S. Benson, Chief of Operations, are reported to be advocates of this type.

The contention of the other body of naval experts is:

Continue to develop the cruiser and the battleship types separately. Increase the speed and effectiveness of the battle cruiser in its special lines and push the weight of armor and the gun power of the dreadnought to the furthest practical point. Among the officers who take this position are several admirals of the department of the General Board.

"The first thing to consider," said Mr. Roosevelt, "is types of ships. It is a physical impossibility to concentrate in one ship the three principal objects aimed at by naval designers. These are speed, protection, and offensive power, in other words, guns. If the design of the ship is to attain extraordinarily high speed, then it is necessary to sacrifice either protection or guns or both. If, on the other hand, the aim is for a ship with the heaviest possible armor and armament, then speed must be sacrificed.

"A great many people have the idea that all that is necessary is an order from Congress that the ship to be built must carry the heaviest guns and the heaviest armor and have the highest possible speed, say 35 knots an hour. But with the present development of hulls and engines, it is absolutely impossible to build a 35-knot ship without reducing weight of guns and armor in some way. On the other side of the problem, the heavier the guns and the armor the more boiler and machinery space have to be cut down, and thereby one of the three chief objects in naval construction, as I indicated—speed—is lost.

"The question therefore resolves itself into one of naval opinion as to the most desirable of the several types of ships, and the decision depends on which side, in the final summing up, the weight of that opinion takes, as to the strategic and tactical uses for heavy ships. It may be said that three schools of thought on this subject exist at this time, and these are built around three types of large ships, as follows:

"First, the almost impregnable battleship which at the same time carries the heaviest known armament, a development, it might be said, of the latest dreadnought in our navy. Such a ship would carry twelve 16-inch guns in the main battery and thoroughly distributed armor of from 12 to 14 inches in thickness, but the best speed that could be obtained for a vessel of this type would probably be not more than 23 knots on a displacement of 35,000 tons.

"Second, the so-called fast battleship, a development of the British H. M. S. *Hood*. A vessel of this type could have a speed of from 29 to 30 knots, but could probably mount only eight 16-inch guns in her battery,

wrong somewhere. It is contended again that the solution of the difficulty can only come through the naval committees having cognizance of coast guard appropriations.

WAR FUNCTIONS

As to the employment of the personnel and vessels of the coast guard when serving as a part of the navy, that matter will undoubtedly be attended to by the general board and, so far as the writer is aware, a tentative or complete plan for the utilization of the service may have already been completed. In a war of any magnitude, is it not possible that the personnel of the coast guard will be required for something other than mere harbor duty or the patrolling of mine-fields? Every officer of the navy has a fairly comprehensive knowledge of the part he will play in the eventualities of war, but it is not so with the coast guard officer, and, while standing ready, he can merely guess. No one seems to know why. True, the vessels will probably be utilized, but would it not be well were they to be manned by a reserve and the active crews released for other work? Who is to officer and man the auxiliary cruisers that would be brought into service? Might not that be a field for the endeavors of the coast guard? The Spanish-American War is not so far in the past as to have the experiences of that time entirely eradicated from the minds of the officers of the navy who were engaged therein, when there was the need for a personnel reserve—one that could stand the hardship of exposure in all weather at sea, a reserve that could be counted on for all-round efficiency and whose officers could be trusted with a deck and to command a division *at sea.*

CONCLUSION

In writing in the statutes that the coast guard shall, as a part of the military forces of the United States, operate as a part of the navy in time of war, or when the President shall direct, the lawmakers assumed a responsibility, as the agents of the people, to see to it that the coast guard is properly equipped and in other ways prepared to become an efficient naval unit when the occasion arises. There was also at that time a great degree of implied responsibility thrown upon the navy, to aid in every manner possible the increase of the military efficiency of the coast guard, which becomes a unit of the navy, as provided in the statute.

in the war. It is for this reason that the Secretary of the Navy has decided that work on our six authorized battle cruisers shall not be resumed until the situation has been surveyed thoroughly and the three chiefs of the navy technical bureaus, Ordnance, Construction, and Repair and Steam Engineering, will spend some time in Europe to go into the problem fully.

"In common with England and France, the United States ceased practically all work on capital ships during the war, because it was obvious that the existing fleets were entirely able to take care of the German capital ships if they had to come out to fight instead of surrendering. Work on the ten dreadnoughts now building for our navy is, of course, going on, and a decision on the battle cruisers will be reached this spring."

"Have the designs of the officers in the navy who advocate a new fast battleship type advanced for enough to make it clear that this proposition is a feasible one?" was asked.

"I will answer that by saying," answered the Acting Secretary of the Navy, "that it is considered possible to build a 30-knot battleship that would carry as many guns and as heavy armor and other protection as the 23-knot battleship, but such a ship would be in every way a bold experiment. It would have to be nearly twice the tonnage and of much greater horsepower—probably 200,000—than the present battleship, length probably above 800 feet, and the main armament twelve 16-inch guns, with an armor from 12 to 14 inches thick. The cost, it is estimated, would go to $40,000,000 instead of $20,000,000. The question then arises whether in our new navy program it is wise to put all our eggs in one basket, for it is obvious that the country would probably not build as many of these ships as of the smaller size costing half as much."

"What effect would the adoption of this new type of ship have on the ships we now have?"

"It would make them obsolete so far as the new ships were concerned, but not as against the existing ships of other navies," was the answer. "So far as I know at present, the British, the French and the other navies are not developing the intermediate type of high-speed battleship, but are maintaining, and continuing, the construction of the separate types of the high-speed battle cruiser and the heavy-powered battleship. If the United States develops the new type of fast battleship in any numbers it will be a tremendous departure, and the sole question is whether it would be better policy to try to put all the advantages in a 30-knot boat.

"I hope I have made the questions at issue clear so the public can understand. Personally I believe in absolute publicity on questions of this kind; in other words, that no attempt be made by the Navy Department to hide one of the most interesting problems that has come up for a long time, but I believe the stand of the public and of Congress should be just what my stand is as a civilian—even though I have been in very intimate touch with naval affairs for six years—and that stand is that judgment as expressed by civilians or by Congress should not control, but that the final opinion of the best-qualified naval officers should be accepted by the country. That opinion should, and will, represent the careful study by naval officers who stand the highest in construction, in ordnance, in engineering, in theoretical strategy and tactics and in actual experience under sea-going conditions.—*N. Y. Times*, 16/3.

MATÉRIEL

APPROPRIATIONS FOR THE NAVY.—Senator Weeks on March 4 obtained leave to put in the *Congressional Record* the army and navy appropriations which have been made by Congress since the year 1900, including the appropriations which were prepared and on the Senate calendar, "to show the increase in the proposed appropriations above those of preceding

years at a time when we are supposed to be entering into a period of universal peace."

The table referred to is as follows:

1900	$ 48,099,969.58
1901	65,140,916.67
1902	78,101,791.00
1903	78,856,363.13
1904	81,876,791.43
1905	97,505,140.94
1906	100,336,679.94
1907	102,091,670.27
1908	98,958,507.50
1909	122,663,885.47
1910	136,935,199.05
1911	131,350,854.38
1912	126,478,338.24
1913	123,225,007.76
1914	140,800,643.53
1915	144,868,716.61
1916	149,661,864.88
1917	313,300,555.84
1918	517,273,802.08
1919	1,238,282,968.56

1918. The estimates of the Navy Department for 1918 amounted to $379,151,701.67, the Senate appropriated $535,637,802.08, and the law for that year carried a total appropriation of $517,273,802.08.

1919. In the estimates of the Secretary of the Navy for 1919, which were sent to the Congress on October 15, 1918, when the United States was still at war, the department asked for appropriations amounting to $2,644,307,046.05. Since the signing of the armistice the Secretary has revised his former estimates, and is now asking an appropriation of $975,903,621.28, which includes $200,000,000 for the construction of battleships, etc., being the first appropriation in a proposed three-year shipbuilding program, costing $600,000,000.—*Army and Navy Register,* 8/3.

PERSONNEL

NAVAL PERSONNEL EMBARRASSMENT.—The naval authorities are in something of a predicament in regard to certain features of the naval personnel because of the failure of Congress to enact the naval appropriation bill. That situation leaves the Navy Department without the authorization of a definite number of enlisted men to which it is possible to demobilize. The bill as it passed the House provided for 225,000 men, which may or may not have included apprentices, etc.; the Senate increased this total strength to 250,000 men, as the bill was reported from the Senate Naval Committee. The opinion of the naval authorities is that Congress will eventually provide for not more than 225,000 men, including apprentices, hospital corps, and so on and, in anticipation of such authorization, it is probable that the demobilization will be so conducted as to reduce the enlisted strength to 225,000 by the 1st of July. As an aid to this project, there will be prepared in the Navy Department tables showing the number of reserve officers, line and staff, arranged according to branches, the number ashore and afloat, respectively, the number of other than commissioned reserves ashore and afloat, and the number of men in the regular navy other than commissioned officers. These tables will exhibit the situation existing on the first of each month up to and including the beginning of the new fiscal year. The Marine Corps, not having obtained its permanent enlisted strength of one-fifth of the navy, or 26,000 men, will probably not be increased permanently if a League of Nations is formed. As to the perma-

nent naval enlisted force, it is estimated that it will amount to 137,000 plus hospital corps men.—*Army and Navy Register,* 8/3.

NAVAL RESERVE PROMOTIONS.—Orders have been issued by the Secretary of the Navy directing the board that met on December 31 last to select line officers of the regular navy for promotion, to reconvene after return of the fleet from the West Indies, to select line officers of the naval reserve force for promotion. Under the schedule of operations movements now in force the fleet probably will not return to home waters until about the middle of April. The board will be instructed to recommend such number of naval reserve officers above the rank of lieutenant as are found pre-eminently qualified for the duties of higher rank in accordance with the act of July 1, 1918. All officers that do not meet in full the standard of the regular service in their respective grades, as modified by requirements for their respective classes in the naval reserve force, will be eliminated from consideration. Promotion of naval reserve officers has been deferred pending efforts to secure legislation that would permit the convening of a special selection board for them. A provision relating to the matter was contained in the naval appropriation bill, which did not pass before adjournment of Congress. Therefore it is necessary to reconvene the last board for the regular navy. This board is made up of Admiral Henry T. Mayo, Vice Admiral Albert Gleaves and Rear Admirals Frank F. Fletcher, Albert G. Winterhalter, Thomas S. Rodgers, Hugh Rodman, Thomas Snowden, John A. Hoogewerff and Edwin A. Anderson, with Commander Harold G. Bowen as recorder. Although no orders yet have been issued to that effect, it is expected that boards also will be convened to select staff officers of the naval reserve force for promotion.—*Army and Navy Register,* 8/3.

NAVY BOARD OF AWARD NAMED TO PASS ON HONOR MEDALS.—*Consists of Eight Retired Officers with Rear Admiral Austin McKnight as President.*—The Navy Department issues the following:

Secretary Daniels to-day appointed a board of award for considering the cases of all officers recommended to receive medals of honor, distinguished-service medals, and naval crosses, as provided for in an act of Congress, approved February 4, 1919.

The board consists of retired officers of prominence whose opinions and decisions could not fail to give satisfaction to the service at large.

The board consists of the following officers:

Rear Admiral Austin M. Knight, U. S. Navy, president.
Rear Admiral Mordecai T. Endicott, C. E. C., U. S. Navy, retired.
Rear Admiral Charles J. Badger, U. S. Navy, retired.
Rear Admiral De Witt Coffman, U. S. Navy, retired.
Capt. Joseph H. Linnard, C. C., U. S. Navy, retired.
Capt. John C. Boyd, M. C., U. S. Navy, retired.
Col. Paul St. Clair Murphy, U. S. Marine Corps, retired.
Capt. Mitchell C. McDonald, P. C., U. S. Navy, retired.

During the early part of the year letters were written to all officers who exercised the function of command, both ashore and afloat, to send in recommendation in the cases of officers under their command whom they deemed worthy of receiving medals. These cases will be considered by the board.—*U. S. Official Bulletin,* 8/3.

OPERATIONS

SIX GERMAN SUBMARINES SOON TO BE BROUGHT TO U. S. PORTS.—*U-Boats Recently Delivered in British Harbors Will Be Exhibited to Public.*—Secretary Daniels authorizes the following:

Arrangements have been completed to bring to United States ports six of the German submarines recently delivered in British harbors. These

vessels, selected as representing the different types of the German submarines, will be brought over for exhibition to the public and for study by our engineers, constructors, and submarine officers of the scientific aspects of the machinery, much of which is understood to be very highly developed.

The status of these vessels is in no wise changed and their ultimate disposition remains subject to the decision reached by the peace conference just like that of the others of the German fleet.—*U. S. Official Bulletin*, 1/3.

LARGE GERMAN SHIPS TAKEN OVER.—America's share of German ships in home waters and which will be turned over to the United States for operation as troop transports comprises a formidable list of 12 German merchantmen, and includes some of the largest vessels afloat. In the group is the gigantic *Imperator* of nearly 52,000 tons, and with a troop capacity of 10,000 men. The list of vessels assigned to the United States, with the gross tonnage and troop capacity of each, follows: the *Graf Waldersee*, gross tonnage, 13,193; troop capacity, 1500; *Pretoria*, 13,234, 1300; *Patricia*, 14,466, 2200; *Cleveland*, 16,960, 3500; *Kaiserin Augusta Victoria*, 24,581, 3800; *Cap. Polonia*, 19,500, 2500; *Cap. Finistene*, 14,503, 2000; *Imperator*, 51,969, 10,000; *Zeppelin*, 15,200, 2700; *Prinz Frederich Wilhelm*, 17,082, 3500; *Burchard*, ——, 3300; and the *Columbus*, 35,000, 8000. The work of repairing and converting these vessels will be done by the navy and they will be operated by the navy for the army account. The first ships will probably arrive in the United States about April 1 and will be assigned to the third naval district for conversion; and if practicable all the vessels will be converted in that district. The plan of division among the Allies provided that the United States would be allotted the large, fast steamers, suitable for transatlantic service. Some of these vessels are practically ready for sea; particularly is this true of the huge *Imperator*, which is reported in excellent condition except for some boiler tubes.—*Army and Navy Register*, 8/3.

WORK OF THE CRUISER FORCE.—The Navy Department has received a report from the commander of the cruiser force, showing that during the month of February 96,368 passengers were landed in United States ports by the cruiser and transport force. Of this number 10,565 were carried by seven cruisers and 7850 by seven battleships. The rated capacity of the vessels arriving was 104,211. The total of invalids carried was 16,356.—*U. S. Official Bulletin*, 8/3.

MERCHANT MARINE

NEW MARKINGS FOR UNIFORMS OF MERCHANT MARINE APPRENTICES.—In order that young Americans entering the Merchant Marine through the United States Shipping Board's training service may be distinguished by their dress from navy men, the Board has adopted distinctive markings for the uniforms of apprentices aboard its ten training ships, on which 3000 men a month are now being drilled for service in merchant crews.

Although of standard seaman's blue and of traditional cut, the merchant marine apprentice's uniform differs particularly from that of the navy man in its new markings. Two broad stripes are worn on the collar and cuffs of the blouse instead of three narrow ones, as in the navy, while instead of white they are "old" blue, the same shade as that on the blouses of British and French merchant sailors. Another distinguishing mark is the insignia of the Shipping Board, an anchor supporting the national shield, worked in silk in red, white and blue on the blouse pocket.

The new uniform, which has just been issued at the Shipping Board's training stations at Boston, Norfolk, New Orleans, San Francisco and

Seattle respectively, was first seen in public on President Wilson's arrival at Boston, February 24, when 1000 merchant marine apprentices, representing all the states east of the Rockies, marched in the President's escort, behind their own band.

The merchant marine apprentices are provided with their uniforms by the Shipping Board and are permitted to wear them after they leave the training ships, at the end of two months' schooling, to take their places in regular merchant crews. Until this country entered the war, uniforms were not worn among American merchant sailors, except by men employed on the deck of passenger liners. The Shipping Board has found that young Americans, now entering the merchant service, have more regard for themselves and their job when in uniform, and that the merchant sailor commands greater respect when ashore, either in home or foreign ports if in uniform.—*Shipping*, 8/3.

TAGGING THE MARINER.—Thumb prints and photographs are parts of a system of identification through which Uncle Sam follows the fortunes of the sailors who are manning the country's new merchant marine.

The merchant mariner is officially weighed, measured, pictured, and thumb-marked before he goes aboard ship, and then is officially tagged as well, his picture and thumb-mark, and the facts pertaining to him being affixed to a small four-page folder, printed on stout paper.

This paper is a vital document. Without it the sailor cannot ship for a voyage. Should he lose it he loses his right to go ashore in a foreign port. Officially he ceases to exist when he parts with it.

It is, in short, a passport, although it is known as a "citizen seaman's identification card." Among sailors it is termed Form K. for short, the paper being so marked in the upper left corner.

Even when actual peace comes, the sailor cannot roam at will in the ports of the seven seas. He is of too much value to his country to be lost from sight in the big economic job of trade expansion. In sailing-ship days, half a century ago, when the sailor went to sea he merely signed for a voyage. With his sailor dress as his credentials, he made himself at home in every port in every land. But he is no longer an irresponsible rover. The American boys who are now entering the merchant marine through the open door of the Shipping Board's Recruiting Service, are prepared to be examined, thumped, pounded, measured, photographed and thumb-printed.—*N. Y. Times*, 16/3.

NAVIGATION AND RADIO

FIRE DESTROYS NAVY RADIO.—*Six Hundred Foot Tower at South San Francisco Complete Loss.*—The Navy Department is informed that the 600-foot radio tower at South San Francisco was destroyed by fire yesterday morning. The fire was discovered shortly before 6 o'clock in the morning about 200 feet from the base. As it was impossible to reach the flames and extinguish the fire, the tower was completely destroyed, falling at 11 a. m.

The report states that the station is out of commission pending the re-establishment of the tower and the antenna, but that temporary arrangements for handling the transpacific traffic and other messages have been made.

An investigation is now being made.—*Official Bulletin*, 14/2.

LINK WIRE AND WIRELESS.—*Discovery in Telephone Operation Reported to Electrical Engineers.*—Wireless and wire telephone systems can be linked so that the human voice will perform one lap of a journey over a wire and the next lap through the air to its final destination, while the replying voice will travel on air waves first and then on wire, according to a paper presented by E. B. Craft and S. H. Colpitts, of the Western

Electric Company, at the convention yesterday of the American Institute of Electrical Engineers, at the Engineering Societies Building, at 29 West Thirty-ninth Street.

The operation of transferring the sound from the wire to the air can be accomplished, the paper said, by a device not more complex than the repeater now used in long-distance telephoning. The two engineers held that wireless telephoning would be a supplement to, and not a rival of, wire systems. The lack of secrecy and the impossibility of keeping thousands of air messages distinct in wireless telephoning in a city, it was said, prevented competition. The future of the wireless, it was said, seemed to lie in communication with ships, trains in motion, islands, and inaccessible places of all kinds and in the broadcasting of weather signals and other news.

ENGINEERING

THE LOOMIS COOLING SYSTEM FOR AIRCRAFT.—*A System Embodying a Nose Radiator, an Adjustable Booster and a New Form of Expansion Tank with Positive Ejection.*—Two features new to airplane cooling systems and which are adaptable to any airplane carrying a water-cooled engine have been developed at McCook Field, Dayton, Ohio, and incorporated in the *USD-9A* day bombing machine. Particulars of these features, comprising what is known as the Loomis cooling system, appeared in a War Department publication of recent date, which is herewith abstracted by special permission.

The Loomis cooling system for aircraft was developed at McCook Field, Dayton, Ohio, and first applied to the *USD-9A* plane. Particulars of this system have been given in a recent issue of the Bulletin[1] of the Experimental Department, Airplane Engineering Division, Bureau of Aircraft Production, War Department, from which the following information has been abstracted by special permission.

The two new features in the Loomis system are an expansion tank that surrounds the core and is an integral part of the nose radiator, thus taking the place of the shell ordinarily used; and an injector in the water connection between the main and booster radiators, which draws water through a nozzle outlet from the bottom of the expansion tank and injects it into the return pipe, thus keeping constant the volume of water in the circulating system.

It is claimed that through these features the loss of water due to steaming or air pockets is minimized and excessive depression in the pump intake is prevented, making possible a much faster water circulation and, therefore, increased cooling efficiency without danger of cavitation in the pump or the drawing in of air around the hose connections on the suction side.

Water from the cylinder jackets enters the upper well of the nose-radiator core in the usual manner, and nearly all of it works down through the core to the bottom of the well, and then through the venturi outlet to the return pipe leading to the booster radiator and the pump. Owing to the action of the venturi, the head of water in the nose-radiator core and the type of pump impeller used, pressure is built up on the intake side of the pump.

A small quantity of water from the upper header of the radiator core normally overflows through holes in the top of the upper well into the expansion tank (Fig. 1) above, and then flows downward in this chamber by gravity. The lowest part of the expansion tank, underneath the lower header of the radiator core, has an outlet nozzle which opens into the

[1] Bulletin of the Experimental Department, Airplane Engineering Division, U. S. A., McCook Field, Dayton, Ohio, Vol. 2, No. 2, November, 1918, pp. 61-68.

throat of, and is concentric with, the venturi outlet from the lower tank. The top of the expansion tank is open to the atmosphere through the vent pipe terminating in the radiator filler neck, so that constant atmospheric pressure is maintained on the water in the expansion chamber, in order that it may be drawn into the return pipe through the action of the venturi at the nozzle.

The auxiliary radiator is located in the water return line between the nose unit and the pump, so that all water from the main radiator passes successively through the venturi and the booster or auxiliary radiator, from top to bottom, before reaching the pump. Fig. 2 shows the connection between the main radiator, injector and booster.

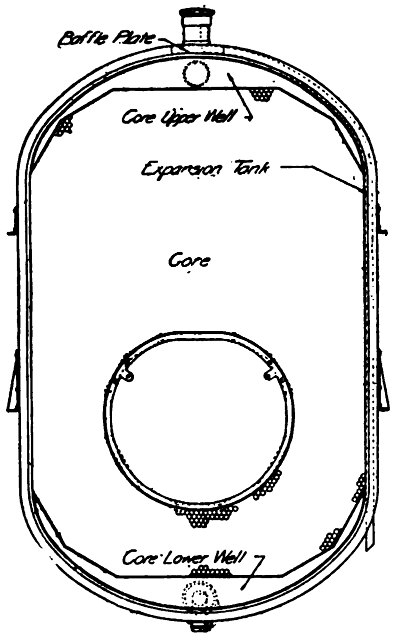


FIG. 1.—Diagram Showing the Expansion Tank Around Radiator Core as Used on the *USD-9A* Plane.

Running entirely around the outside of the nose-radiator core and its upper and lower headers is a separate compartment, ⅞-inch wide, and of the same depth as the core, which acts as an expansion chamber for the cooling system. The only communications between this tank and the upper well of the radiator core are three $\frac{3}{16}$-inch vent holes. As shown in Fig. 3, the bottom of the well of the core communicates only indirectly with the bottom of the expansion tank through the venturi and nozzle. The injector consists of a $1\frac{1}{16}$-inch diameter venturi outlet from the lower tank or well of the radiator core, with the ½-inch diameter nozzle of the outlet pipe from the bottom of the expansion tank projecting into the throat. The general construction of the outlet is shown in Fig. 3.

Mounted in a vertical rack to the rear of the engine and transversely to the fuselage is the adjustable booster radiator, which is connected in series with the nose unit. The auxiliary radiator may be lowered to project

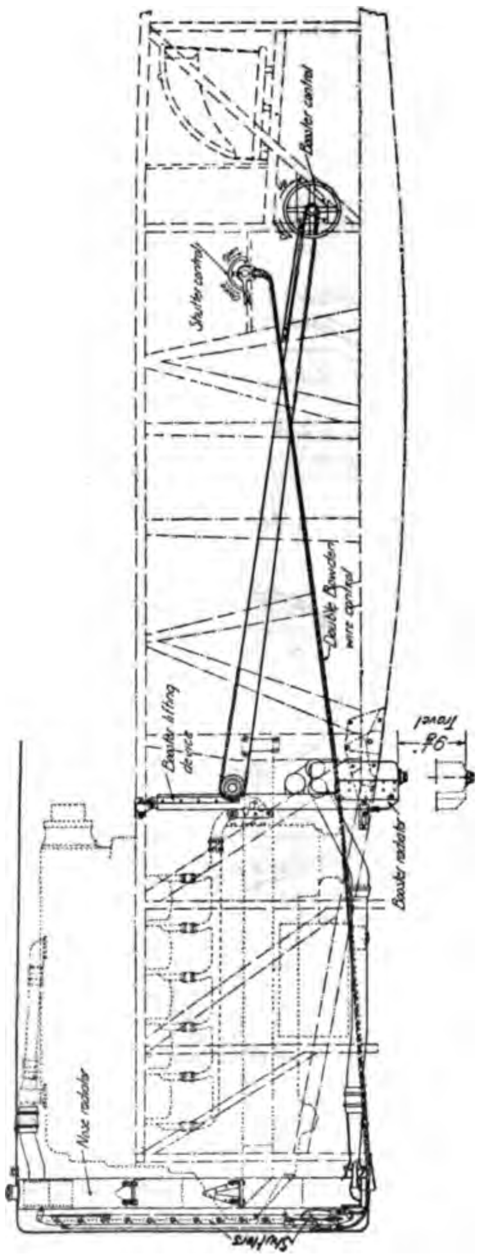


FIG. 2.—*USD-9A* Cooling System.

9⅛ inches below the bottom cowl of the fuselage, or drawn up into the body until only the edge of the lower tank is exposed.

When the auxiliary unit is lowered to its extreme position, practically its entire surface is exposed to the air stream under the fuselage.

In its upper position this radiator has very little cooling effect, as it is then almost entirely enclosed in the fuselage and only a small amount of air can circulate through it. Most of the air going through the nose radiator is discharged through the louvers in the engine cowls forward of the booster.

The auxiliary cooling unit is raised or lowered by a handwheel on the right side of the pilot's cockpit, which is connected by short lengths of chain and intervening wires with a pinion meshing with a rack attached to the upper part of the auxiliary radiator. The pilot can set the booster unit to project any desired distance below the under side of the fuselage, within the limits provided, in order to obtain the exact amount of cooling capacity needed under different conditions.

While both the nose-radiator shutters and the adjustable-booster unit are provided for the same purpose, that is, to increase or decrease the cooling capacity of the system as a whole, it is the practice to open the

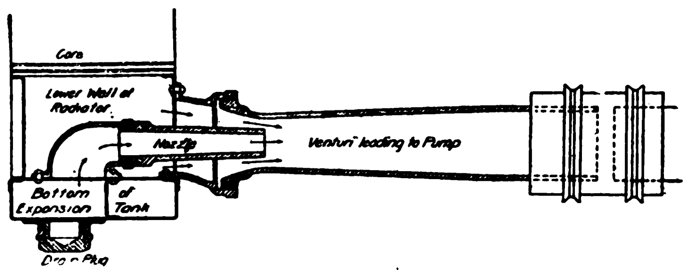


FIG. 3.—Injector Device at Bottom of Nose Radiator.

shutters first and to lower the auxiliary radiator later, to provide still greater cooling capacity, and vice versa, thereby keeping the parasite resistance down to a minimum.

A series of test flights was made at McCook Field with two DeHavilland-4 planes to determine the relative efficiency of the new cooling system designed for the *USD-9A* in comparison with other comparable types. Owing to the similarity in size between the DeHavilland-4 and the *USD-9A*, and to the fact that both planes carry standard Liberty-12 engines, it was considered that the tests would give a good indication of the performance to be expected of the new system in the *USD-9A*.

The other radiators tested on the same planes for comparison were the Wolverhampton, used in the British DeHavilland-4, and rated as adequate for a 350-h. p. engine, a special American Monogram radiator made by the A-Z Co., and two sample Mayo radiators with ribbon-type cores. These last two were especially designed for the American DeHavilland-4 with Liberty engine. The units tested were near enough alike in general features to offer a fair basis of comparison for the *USD-9A* system.

By means of preliminary tests a type of pump impeller was selected which was found to be well suited to the new system which produces a certain amount of pressure on the intake side of the pump due to the action of the injector. For use with the Wolverhampton radiator, it was necessary in order to prevent excessive suction to cut down the standard straight-blade impeller with the DeHavilland-4 to 3¼-inch diameter. The regular pump impeller was used without alteration with the other radia

tors tested. The original report gives the curves of pressure on pump inlet both developed by the straight-bladed pump impeller cut down to 3¼-inch diameter for the English radiator and by the *USD-9A* radiator with curved-blade impeller used with the Loomis system.

Various precautions described in the original report were taken to insure the correctness and comparability of results obtained with various radiators.

One of the interesting features developed in the tests is that the greatest difference between air temperature and water outlet temperature was found at altitudes between 3000 and 5000 feet, which tends to prove the assertion that a radiator which is adequate up to 3000 feet under rapid-climb conditions will probably provide sufficient cooling capacity for all purposes.

The following conclusions are made in the report, which also gives the main data secured in tabular form.

Taken on the whole, the *USD-9A* radiator tests yielded quite good figures for efficiency, which can be depended upon as reliable. The efficiency values obtained in the various trials of this system were:

With no engine top cowl, bottom cowl with extra louvers—91 per cent.

With extra louvers in top and bottom engine cowls, average of two tests—88.8 per cent.

With standard top cowl and no louvers in bottom cowl, average of three tests—87.8 per cent.

These figures indicate that although something is gained by extra louvers in the cowling, still the engine and its front bearer in the *USD-9A* obstruct the flow of air through the nose radiator to such an extent that the only great gain to be obtained would be by using wide lateral openings in front of these two units to exhaust the air passing through the nose radiator.

Steaming falsifies the apparent efficiency of a radiator, as it reduces the amount of cooling required to be done by the cooling system. A steam calorimeter in the overflow tube would be necessary for accurate corrections.

The only comparisons possible with the other radiators tested must be based on the figures obtained during those trials where no steaming of the other units took place. The comparative results obtained in such tests, with corresponding figures for the *USD-9A* system, are given in Table 1.

TABLE I. COMPARATIVE EFFICIENCY OF RADIATORS

Radiator	Efficiency, per cent	Cooling surface, square feet	Weight full, pound
Monogram	76.75	202	176.5
Wolverhampton	82.5	246	142
USD-9A	91	219	204.5

The addition of engine top cowling must produce less effect on the new cooling system than on the other two radiators mentioned in Table 1, for the reason that part of the total cooling surface of the new system, represented by the booster radiator, is independent of all cowling above or below the engine, provided, of course, the lower cowling does not obstruct the auxiliary unit when in its lowest position. The addition of shutters on the nose radiator also produces less effect on the *USD-9A* cooling system than on the others, and for the same reason.

With this radiation system any reasonable increase in cooling capacity can be obtained by adding to the height of the auxiliary radiator. It is quite probable, however, that the present amount of auxiliary radiation is sufficient in view of the fact that very little steaming was encountered even under the severe conditions of the tests. Under ordinary conditions the high-compression Liberty engine is not intended to be run at full throttle near the ground, as was done in these tests.—*Mechanical Engineering*, 19/3.

AERONAUTICS

OCEAN FLIGHT WITHIN MONTH.—*England, Says Admiral Taylor, May Try Dirigible Next Week.*—Rear Admiral D. W. Taylor, Chief of the Naval Bureau of Construction and Repairs, announced that the navy would be ready to attempt the flight by heavier than air craft across the Atlantic Ocean within a month.

"I do not believe that Great Britain will beat us across," he said, "if the attempt is made with heavier-than-air craft.

"We are under the impression in Washington, however," he continued, "that a dirigible trip will be undertaken by England possibly during the coming week. The navy has four flying boats of the *N. C.-1* type, and work on these is almost completed. It has not yet been decided whether all four will be sent over at the same time, but I believe that more than one will start. That will insure against total failure should one or two break down."

Admiral Taylor said that he was not certain whether a non-stop trip would be attempted. "We may break into two hops," he said, "and this will entail the use of airplane mother-ships, vessels equipped with oil, gasoline and food."

"Through their wireless apparatus," he added, "mother-ships can keep in touch with the flying boats. Although the flying boat may alight only once at sea, it is possible that more than one mother-ship could be used."—*Baltimore Sun*, 18/3.

The United States Navy Department has successfully carried out the experiment of launching an airplane from a dirigible balloon. The airplane was attached by a 100-foot cable to the dirigible; both rose to about 3000 feet and then the airplane was released; after diving about 1000 feet it obtained sufficient speed to continue its usual flight.—*Mechanical Engineering*, 19/3.

AIRSHIP WAS UP 100 HOURS.—A British airship, according to General Seeley, recently remained in the air for more than 100 hours. At an average speed of 50 miles an hour, the Under Secretary added, the airship must have covered more than 5000 miles. It was possible that the airship could have continued longer in the air, notwithstanding the fact that it encountered considerable wind.—*N. Y. Times*, 22/2.

MAKES AIR-FLIGHT RECORD.—*Lieutenant Harmon Negotiates Washington-New York Route in 85 Minutes.*—The Director of Military Aeronautics issues the following:

Lieutenant Frank H. Harmon, pilot of Bolling field, Anacostia, February 19, established a record flight from Washington to New York by airplane in a La Pere plane.

He landed at Hazelhurst, N. Y., 85 minutes after his "take off" at Bolling field.—*U. S. Bulletin*, 27/2.

GIANT SEA PLANES MAKE NEW RECORD.—Two giant United States naval flying boats of the *F-5-L* type broke all records in a 300-mile non-stop flight from Hampton Roads to New York City yesterday. The flight was made against a strong head wind in four hours and a half. Each of the two great flying machines carried seven passengers and a gross load of 13,000 pounds.

During the flight the *A-1070*, one of the two flying boats, developed trouble in one of her 400-horsepower Liberty motors. While the huge machine continued on in the teeth of the stiff breeze Chief Mechanic Sacks overhauled the defective engine and succeeded in repairing the fault in mid-air. After this the flight proceeded without further incident.

fore turret was put out of action. The entire crew of the turret and magazine were killed, with the exception of three or four men. The ship was beached in a sinking condition, but was afterward refloated and repaired. She suffered heavy casualties.

Battleship *Grosser Kurfürst*, damaged by a torpedo and four heavy shells. Engines were damaged.

Battleship *Markgraf*, badly damaged, a torpedo having struck her.

Battleship *Oldenburg*, hit by a shell from a destroyer, which killed eleven and wounded about a dozen, mostly officers on the bridge.

Battleship *Ostfriesland*, struck a mine, which tore a large hole in her starboard side. She was assisted into port by salvaging vessels.

Battleship *Schlesien*, slightly damaged by splinters and injured in a collision which occurred when she attempted to avoid the torpedoed *Pommern*.

Battleship *Schleswig-Holstein*, so badly damaged that the repair work necessary required several weeks.

Heavy Losses on the Luetzow.—Battle cruiser *Lützow*, sustained at least 40 direct hits from British gunfire, which did enormous damage, and was also twice torpedoed in the evening after the battle. She was abandoned the next morning and sunk by two German torpedoes. Her casualties are variously given as being from 400 to nearly 600.

Battle cruiser *Derfflinger*, so badly damaged that she had to be reconstructed, a large quantity of armor and guns from the unfinished *Hindenburg* being used for that purpose.

Cruiser *Moltke*, hit by three large shells, and was under repairs until August.

Cruiser *Von der Tann*, one turret completely put out of action and another virtually useless.

Cruisers Sunk to Prevent Capture.—Light cruiser *Elbing*, so badly damaged that she was scuttled to prevent her from falling into the hands of the British.

Light cruiser *Rostock*, after being damaged by gunfire, was blown up by her crew to prevent capture.

Light cruiser *Wiesbaden*, reduced to a complete wreck by gunfire and was finally torpedoed. There was only one survivor of her crew.

Light cruiser *Frauenlob*, set on fire and wrecked by gunfire, torpedoed and sunk. Only eight of her crew survived.

Five destroyers are known to have been sunk, while others had to be towed into port.

A complete record of the British forces engaged in the battle shows 24 dreadnoughts, 8 battle cruisers, 18 cruisers, 18 light cruisers, and 78 destroyers. The German force included 21 battleships, 16 cruisers, and 77 destroyers. It is clearly established, however, that of the ships which actually came into action the preponderance of force was held by the Germans.—*N. Y. Times.*

729 KILLED AND 1,754 INJURED BY ALLIED AIR ATTACKS.—Copenhagen, March 16.—Seven hundred and twenty-nine persons were killed and 1754 injured in aerial attacks by Allied forces in German territory up to November 6, 1918, according to official figures made public in Berlin.—*Baltimore Sun*, 17/3.

THE RETURN OF THE TROOPS.—*An Address by the Commissary of the People, Haase.*—Berlin, December 12.—At the arrival of the divisions of chasseurs made up of troops from all parts of Germany, Haase, the commissary of the people, held the following address near the Brandenburg gate:

"Soldiers, the council of commissaries and the government of the socialist republic greet you in the most cordial manner. We have sympa-

produced helium at the rate of 3000 or 4000 cubic feet per day, but as this production was far below what would be required for the needs of the War Department and the Navy Department, to say nothing of that of our Allies, it was determined to undertake production on a large scale, and for this purpose contracts were entered into by the Navy Department, acting for both the War and Navy Departments, for the construction of a plant at Fort Worth having a capacity ten or twelve times as great as the experimental plant from which helium had been produced.

"The necessary machinery for equipping this plant is now nearing completion, and the buildings will soon be under construction.

"In order that the supply of this rare gas may be conserved contracts have been entered into with the owners of the wells supplying it, by which the use of this gas for domestic purposes will be limited to such an extent as to conserve it for a period varying from 10 to 20 years. The necessity of doing this will be evident from the fact that foreign governments have already shown the greatest interest in this gas and are making every effort to secure a supply of it. The importance of conserving it is so great, however, that officers of the War and Navy Departments believe that Congress should lose no time in enacting legislation which will secure to the government the sole control of all helium-bearing gas in this country.

"In explanation of the great military value of the gas it is stated that one shot from an explosive bullet is sufficient to explode the hydrogen-filled balloon of any airship, while the same balloon filled with helium is absolutely safe from attack.

This was thoroughly demonstrated by the Navy Department before the signing of the armistice by conducting experiments at Anacostia on balloons filled with hydrogen and others filled with helium, which, at the time, was disguised under the name of argon. One shot into the hydrogen balloons was sufficient to explode them, while a number of shots into the argon-filled ones produced no effect other than a scorching of the envelope at the point of entrance of the bullet."—*Secretary Daniels' Nat'l Press Club Speech, 25/2.*

THE DOUBTFUL FACTORS IN THE PROBLEM OF TRANSATLANTIC FLIGHT.—That a flight across the Atlantic Ocean will be made in the immediate future is almost certain. It is, in fact, altogether remarkable that isolated feats of this kind have not been achieved before now. The establishment of anything like a regular aerial transport service over the Atlantic is, however, quite another matter. It would be unsafe to predict how soon, and under what conditions, this will be realized.

The monumental report of the Civil Aerial Transport Committee, recently published in England, embodies some discordant ideas on this interesting question. Few persons give more study to the problem of transatlantic flight than Commander Porte, whose preparations to undertake such a journey in the summer of 1914 were terminated by the outbreak of the war. This authority, as quoted in the report just mentioned, believes that the direct route between Ireland and Newfoundland is at present out of the question, and that for many years to come the only practicable route will be by way of the Azores. Commander Porte also considers Newfoundland an unfavorable terminus for the westward journey, on account of the obstacle opposed to a safe landing by the notorious fogs of that region. He prefers a landing ground on Long Island, though its distance from San Miguel (Azores) is about 2250 nautical miles, as compared with 1346 miles from San Miguel to Newfoundland.

The elements of uncertainty in transatlantic flying are almost wholly meteorological. The proposed Azores route offers the advantage of the trade winds for the westward journey. Whether, and to what extent, the counter-trades, which blow above the trades and in the opposite direction, could be utilized for the return journey to Europe is still doubtful, because we lack precise information about these winds; particularly as to the level

at which they blow. In higher latitudes westerly winds prevail, but they are much interrupted by cyclonic storms. Here, again, the question arises whether it would be possible to fly high enough to secure comparative immunity from adverse currents.

That the coasts of Newfoundland are habitually shrouded in fog seems to be taken for granted in all speculations about Atlantic flight. The British report, however, contains two communications from authoritative sources which emphatically discredit this idea. Sir E. Morris, who has lived and yachted along the Newfoundland coast for years, declares that fog prevails there only with winds from a quarter between northeast and southwest, while the prevailing winds are from west and northwest. He has seen a whole season from April to November pass without rain or fog. He also emphasizes the fact, borne out by a letter from another resident of Newfoundland, that the fogs of that region are generally very shallow. This, we recall, was likewise the experience of the U. S. Coast Guard observers.

The moral of all this seems to be that a meteorological and aerological survey of the North Atlantic Ocean and the adjacent coasts should be undertaken as soon as possible, with special reference to the needs of aeronautics. That air lanes across the Atlantic are destined to become of great economic importance hardly admits of doubt. The study of surface meteorological conditions over the ocean, the corner-stone of which was laid by Maury in the middle of the last century, has yielded results of indispensable value to mariners. Maury depended for his data upon the mariners themselves; but the Maurys of the air should better this plan and *anticipate* the demands of aerial navigators, by a systematic campaign of scientific expeditions *ad hoc*. This method would obviate heavy losses in both life and money in the early stages of trans-ocean flight.—*Scientific American*, 3/1.

AERIAL MAIL IN THE UNITED STATES AND ABROAD.—By Otto Praeger, Second Assistant Postmaster General.—The Aerial Mail Service was inaugurated May 15, 1918, and during the first six months of its existence its operations covered 68,892 miles, at a cost of $75,165.94, including 6 per cent on investment and 33⅓ per cent for depreciation. In that period it carried between Washington and New York 7452½ pounds of aeroplane mail. The revenue derived was $60,653.28. The net deficit, not taking into account the 6 per cent interest on investment, was $8,969.08. In addition to the aeroplane mail carried there was dispatched between Washington, Philadelphia, and New York in the six months' period a total of 91,926½ pounds of first-class mail, aggregating 3,667,040 letters. This mail was advanced in dispatch from 6 to 12 hours, which many times made up for the small deficit in the operation of this service. This ordinary mail was letter mail from distant states, which was carried in addition to the aeroplane mail. Thus the ordinary mail put on the planes at Washington was usually mail from the South Atlantic Coast states and the Gulf states, distributed to carriers by the Railway Mail Service before reaching Washington, and by reason of aeroplane dispatch was delivered in New York on the same afternoon instead of the following morning.

The Washington-New York route was established not as a typical commercial line, but to solve the problems that had to be met to establish a daily dependable schedule. The flying record made on the New York-Washington line has never been equaled in the history of aviation, and its operation by civilian flyers of the Post Office Department has far exceeded its operation while under military control, the civilian fliers having a record of but seven forced landings in 100 consecutive flights and only two failures in that time on account of fog or storm conditions. The mail has been carried in blinding rain and hail, on fog-bound days with visibility of not over half a mile, and in the face of gales. Only two winter gales were strong enough to prevent the aeroplanes from com-

pleting their journey. On Thursday, January 23, the mail was brought south as far as Silverside, Del., in the face of a 65-mile gale at an altitude of a few thousand feet.

The fastest time of flight carrying the mail from College Park to Belmont Park, N. Y., a distance of 218 miles, was 1 hour and 30 minutes, and the slowest time for a continuous flight was 4 hours and 56 minutes. The average time is 2 hours and 40 minutes. The common experience of the users of aeroplane mail is that a letter posted in the down-town stations in Washington as late as 10.50 a. m., and leaving the aviation field at 11.30 a. m., is usually delivered between 4 and 4.30 in the afternoon, which is in ample time before close of business.

Extension of Service.—The greater distance between the points on an aerial mail route the greater is the service rendered to commerce and the greater is the patronage of the line. A mail service leaving New York at 6 in the morning and arriving at Chicago before 3 o'clock in the afternoon, in time to connect with carrier deliveries, will advance the mail between the two cities by 16 hours over any train dispatch that can be made after the departure of the Twentieth Century Limited from New York at 2.45 p. m. The department desires to establish this line immediately and extend it west to the foot of the Rockies during the coming fiscal year, with the view of reaching the seaports of Seattle and San Francisco, if Congress authorizes the appropriation necessary. The air mail time between New York and San Francisco will be less than 40 hours. It is desired that this transcontinental trunk line shall be tapped by lines from Minneapolis, St. Paul, St. Louis, Kansas City and other points, and ultimately by a line from Boston, via Albany, Buffalo and Detroit, to Chicago.

A north and south trunk line from Boston to Atlanta should likewise be established, with an ultimate extension from Boston to Montreal, Canada, and from Atlanta, via Key West, to Habana. Based on the accurate cost accounting kept in the operation of the Washington-New York air mail line, the cost of an east and west trunk line from New York as far west as Omaha and a north and south trunk line from Boston to Atlanta has been carefully estimated at $1,600,000. To this should be added $400,000 for several essential feeders that would connect up Detroit, Minneapolis and St. Paul, St. Louis, Kansas City and other points, and would admit of an extension as far west as Salt Lake City, this extension, however, dependent upon the extent to which the government equipment can be transformed into strong and safe mail-carrying machines.

For this reason it would be very desirable to obtain an appropriation of $2,000,000 for the ensuing fiscal year.—*Flying*, March, 1919.

THE SIGHTING PROBLEMS OF THE AVIATOR.—One of the greatest difficulties experienced by aerial fighters, when machine guns on airplanes came into general use, was to hit the target aimed at. This may seem, to the uninitiated, like a bald statement of poor marksmanship, but in reality it is not. As a matter of fact, to bring down an enemy machine without specially designed sights is nothing more nor less than pure, unadulterated luck.

For instance, imagine two machines passing each other along parallel lines, 100 yards apart, each traveling 100 miles per hour. You are equipped with a machine gun firing 700 shots a minute—11 each second—the bullet traveling at the rate of 4,960 feet per second. If you took a dead aim at the enemy machine your first bullet would miss its mark by 18 feet, and the second bullet, coming 1-11 of a second behind the first one, would miss its mark by 45 feet.

To offset this, and to make aerial fighting more of a science, ring sights were devised. These sights consist of two rings, a small one, representing the bull's eye, and a larger one encircling it, representing the line of flight of the bullet. If aim is taken when the enemy machine is crossing the outer

circle (the hostile aircraft being 100 yards distant and traveling at the rate of 100 miles per hour) the bullet would reach it as it enters the smaller ring, constituting a direct hit.

But this only compensates for the speed of the enemy machine. You still have to make allowance for the speed of your own machine. This is done by means of the Norman Compensating Foresight, a bead sight fitted to a swivel, with a wind-vane swinging on one side, which raises and lowers the bead, and revolves on its axis, according to the pressure of the wind in the slip-stream.

The most wonderful of all sights, however, is the Aldis Optical Sight, used for stationary guns when firing through the blades of the propeller. This sight was invented by the two Aldis Brothers, manufacturers of lenses, who, under subsidies from the British Government, have brought the making of high grade lenses to a higher point than the German's finest workmanship.

The Aldis sight is virtually a telescope which neither magnifies nor diminishes, and which, unlike an ordinary telescope, can be used with the eye several inches from the end of the tube.

SILHOUETTES ILLUSTRATING THE USE OF THE RING BACK-SIGHT WITH THE WIND-VANE FORE-SIGHT.

(The former is set for the estimated speed of the adversary, while the latter automatically compensates for the speed of the plane on which it is mounted. The upper row of silhouettes is for a range of 200 yards; the lower row shows the same objects at 100 yards.)

When looking through this tube at a distant object the effect is exactly as though one were looking through a napkin ring—the object appears the same whether it is seen through the tube or outside it—but, apparently suspended in the air, is a ring sight. The peculiarity is that the ring is seen with its center on the spot at which the tube is pointing, no matter where the eye is placed. If the eye is moved sideways the ring appears to move with it through the telescope, so that the direction in which the tube points is always toward the center of the ring.

The tube, when fixed rigidly to a gun, thus constitutes a sight which offers practically no obstruction to the view, and which shows instantly the spot at which the gun is pointing, without the necessity of alining the eye on a front and back sight. The effect produced on the pilot of seeing an enemy machine flying into this ring suspended in mid-air is quite startling.

One advantage of this sight is that it can be used with both eyes open. One eye sees the object and the circle through the tube, the other eye

sees the object direct. The effect, after a little practice, is that the object is seen as clearly as though there were no sight at all.

The tube is about three feet long and about three inches in diameter, and contains five specially constructed and arranged lenses.

One fact about aerial fighting, however, which has never been mentioned is that, after the first sight has been obtained, the pilot never uses his sight at all. He watches the bullets—literally! That is, he watches the tracer ammunition. One in every three shots is a tracer—a bullet which trails a little path of smoke; and it is much more interesting to watch the tracers than it is to keep the eye on the sights. Most pilots would like to use *all* tracers if they could, for they kill as readily as the regular bullets. But, unfortunately, tracer ammunition is dirty, and will soon choke the bore of the gun. As it is, a great many pilots load their magazines and belts with every other one a tracer, though it is strictly against the rules. The temptation though is too great to be resisted.

The tracer is made the same as the ordinary bullet, except that, in the end, is a small quantity of magnesium which ignites. It is not quite accurate, as it is lighter and drops a little in its flight, but it serves its purpose wonderfully.—*Scientific American*, 15/2.

MISCELLANEOUS

300,000 IN A. E. F. BY JULY 1, IS PLAN.—*General Pershing Announces Eighteen Divisions to be Returned by that Time.*—Announcement by General Pershing's chief of staff that eighteen National Guard and National Army divisions were scheduled to sail from France before July 1 apparently confirms reports which have been current here that the expeditionary forces were to be reduced to a total strength of 300,000 by the end of the current fiscal year.

Calculations in the various War Department bureaus, it is said, have been based upon the 300,000 strength in figuring on the maintenance of the army abroad after July 1.

The announcement from France indicates that in addition to the seven regular divisions now in France and into which presumably men desiring to remain temporarily are being transferred, the American forces after July will include the 78th and 81st National Army divisions and one other division. This would give a nine-division strength for the combatant forces and allow one division for employment as a depot unit.

While the statement from Paris named only eighteen divisions, all others now in France except the seven regular and four National Guard and National Army divisions already are on priority for early return, and have been skeletonized and are returning as casuals.

German shipping, which now becomes available, will be used in the repatriation of the troops. The order of precedence of their return is based on the order of their arrival. The only exceptions to this ruling will be when the availability of rail and sea transportation, the relative location to ports of the controlling military situation makes the exception necessary.

Troops in the service of supply and labor troops will be returned in the order in which their services can be spared, and as far as possible in the order of their arrival in France.—*N. Y. Times*.

72,951 DEATHS IN OVERSEAS FORCES AND 34,493 AMONG TROOPS AT HOME.—The following statistics showing the number of deaths during the war in the American Expeditionary Forces and among troops in the United States have been prepared by Statistics Branch, General Staff, War Department.

Figures for the United States are from April 1, 1917, to February 14, 1919; for the American Expeditionary Forces, to February 16, 1919.

Source of information: Current statistics section and medical records section, Division of Sanitation, Medical Department.

	American expeditionary forces	United States	Total
Disease	20,829	32,737	53,566
Battle	48,768	.....	48,768
Other	3,354	1,756	5,110
Total	72,951	34,493	107,444

—*U. S. Bulletin,* 25/2.

The destroyer *Ingram,* said to be the first vessel in the United States Navy named for a non-commissioned member of the service, was launched at the Fore River plant of the Bethlehem Shipbuilding Corporation at Quincy, Mass., late last week. It was named after Osman Kelly Ingram, chief gunner's mate of the destroyer *Cassin,* who was killed when that vessel was torpedoed by a German submarine. The *Ingram* was christened by the sailor's mother, Mrs. M. E. Ingram, of Park City, Ala.—*Shipping,* 8/3.

CONSCIENTIOUS OBJECTORS REFUND $8,589 ARMY PAY.—The War Department authorizes publication of the following statement:

The War Department has received from conscientious objectors as refunds of pay the sum of $4,319.82. Conscientious objectors have also refunded their pay through the channel of the Y. M. C. A. to the amount of $270. The Friends' Society had received up to February 15, $4,000 designated for Friends' reconstruction work from conscientious objectors unwilling to accept pay from the army. This makes a total of $8,589.82 thus refunded.—*U. S. Bulletin,* 28/2.

PROGRESS IN FINDING JOBS FOR RETURNED SOLDIERS AND SAILORS.—More than 75 per cent of the returning soldiers and sailors who need assistance in finding employment are being placed in jobs through the United States Employment Service, the Department of Labor announces.

The employment service is finding that of the average 60,000 men weekly discharged from the army, 30 per cent, or 18,000, must find new work, and that 20 per cent of the total, or 12,000, each week are being placed in employment through the Federal Employment Service and its co-operating welfare, civic, and other organizations. The placement figures are based only upon the reports of men known to have been placed, and it is estimated that at least 5 per cent more are being helped to jobs through the employment service. There is a much higher percentage of men needing new jobs among the soldiers from the industrial centers than from the agricultural districts.

The employment service is conducting its soldiers' placing work through offices and agents in all demobilization camps and 2000 special bureaus for returning soldiers, sailors, and war workers in the towns and cities. The bureau for returning soldiers and sailors of the United States Employment Service in the District of Columbia, for instance, has thus far received 2113 applications from soldiers for jobs, and of this number has placed all but 50.—*U. S. Bulletin,* 28/2.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

REVIEW OF REVIEWS. March.—The Navy's New Task, by *Secretary Daniels.*

ATLANTIC MONTHLY. **March.**—The Territorial Claims of France, by *René Pinon.* The Peace Congress and the Balkans, by *J. O. Bourchier.* Bolshevism: a Liberal View, by *H. W. Stanley.*

HARPER'S MAGAZINE. **March.**—How the War Was Won, by *General Malleterre.*

TIMES CURRENT HISTORY. **March.**—Heroism of Torpedoed Transports (Official Narratives). Sinking of the *Viribus Unitis,* by *Lieut. Col. R. Rossetti.*

WORLD'S WORK. **March.**—At Home with Admiral Beatty, by *Francis T. Hunter.* The Surrender of the German Fleet.

FLYING. **March.**—Value of Dirigibles for Aerial Transports, by *Henry Woodhouse.* Regulations of Future Air Traffic, by *Alan R. Hawley.* Aero Radio Surveying and Mapping, by *John Hays Hammond.*

PAN AMERICAN BULLETIN. **December.**—Latin-American Trade—A Comparative Survey.

SCIENTIFIC AMERICAN. **March 15.**—The North Sea Mine Barrage (I), by *Capt. Reginald R. Belknap, U. S. N.* Future of British Flying, by *C. H. Claudy.* Reflecting Prisms—Their Use in Place of Mirrors, by *Naval Instructor T. V. Baker, R. N.*

GREAT BRITAIN

ENGINEERING. **Feb. 21.**—The Industrial Progress of Japan. The Development of Airplanes in the War.

LAND AND WATER. **Feb. 20.**—Lord Jellicoe's Case, by *Arthur Pollen.*

the narrow material standards they were able to understand, overwhelmingly powerful, they assumed that the enemy would be afraid—just as they themselves were unprepared—to attack. Accordingly they did not protect the fleet bases nor prepare for thwarting the under-water war which, had their plan been right, was the only form of war in which the enemy could engage. And, having misconceived the whole nature of war, they could not, of course, select men for the chief command on any proof of their fitness for it, nor could they train or prepare them to engage in it.

When war broke out, a member of this group, whose singular personal charm, firmness of character, grasp of detail, and talent for organization, had made him by much the most effective and influential, was sent to command the fleet which was in all essentials his own creation, and to carry out the plans of which he was so largely the author.

The Testing of a Theory.—The test of the whole work of this group naturally, and inevitably, came when the chief fighting forces of the opposed sides met at the Battle of Jutland. And those who thought this group mistaken in its aims and methods, pointed out that the commander-in-chief on that occasion was true to type. They asserted that he did not bring his fleet into action as would a man who was determined to win a decisive victory as rapidly as possible; that, on the contrary, he left the fast division of the fleet unsupported at the most critical moment; that, when circumstances enabled him to retrieve the situation, rather than allow his fleet to face the risk of a torpedo attack, he turned his ships incontinently away, and so allowed Admiral Scheer to escape. On the morrow—they went on to say—no effort was made to redeem the failure of the day before.

This, briefly, is the indictment that has been brought against the Material School and Lord Jellicoe. When, therefore, it was announced that he was about to publish a volume on his command of the Grand Fleet and the Battle of Jutland, it was natural people should expect a reasoned reply to the case that had been brought against him. *The Grand Fleet*, 1914-1916 (Cassell, 31s. 6d. net), shows that this expectation was founded on a complete misjudgment of Lord Jellicoe as a man, and consequently upon a complete misconception of his object in writing.

The Grand Fleet, 1914-1916, is not a reply to the case I have set out above, nor is it a defence of the author's policy, nor, in the narrower sense of the word, is it an apology. Take the charge that the navy was unprepared. Lord Jellicoe, so far from attempting to justify either himself or those with whom he was so closely associated both in pre-war days and after, carries the indictment to lengths that no critic of the Admiralty has ever thought of in his dreams. The policy of adopting dreadnoughts had indeed been questioned; but no one had ever suspected that every single ship of this type had been built on a hopelessly wrong constructional principle, and so built to the knowledge of those who ordered the construction. We knew that the wrong place had been chosen for the fleet base, and that it was undefended against submarines and mines. But we had no conception that no provision of any kind had been made for putting it into defence for war, and that it was without the means of fitting or supplying a single ship, or of providing the most elementary facilities for the most vital of the fleet's activities, namely, gunnery practice. The degree to which we were under-supplied with light craft as compared with the enemy was almost incredible. We had a bare quarter of their provision! We were without the means of making or thwarting under-water war generally, and in a host of crucial matters—range-finders, fire control, armor-piercing shells, searchlights, and substitutes for searchlights—we were at a disadvantage that is inconceivable. The curious thing is that as to every one, almost, of these points, controversy had been active before the war, and almost everything which experience showed to be necessary had been urged, but without success, on the boards of which Lord Jellicoe

was a member. The gallant officer's category of defects is a stupefying arraignment.

The Battle of Jutland.—When we come to Jutland, the thing is more extraordinary still. He meets the charge of unwillingness to fight at decisive ranges by explaining, with almost painful precision, why it was he feared the Grand Fleet could not survive—in sufficient strength to safeguard Allied interests—if, even for a moment, it were brought into close action with the enemy. He then goes on to show how, between 6 and 6.14, he had the choice of two modes of deployment only, and, by exquisitely careful plans, he proves to demonstration that by neither method could he either bring the fleet into action or come to the support of Sir David Beatty's squadron. Then, when at last his fleet was in action, he tells us with meticulous accuracy why at 7.23—though he knew that a German Fleet in being "was the worst possible thing for us"—he turned his ships away from the enemy the moment the first of the two great torpedo attacks was made, and then how it was just this turn, and nothing else, that enabled Scheer to break off the action and escape. And finally, with the same sustained candor, he tells us how on the morning of June 1st he expected the enemy to be at a certain place and at a certain hour, how he knew the enemy's ships had been battered and damaged, and how, nevertheless, with 25 undamaged battleships against the enemy's 20 cripples, he did not attempt to intercept them and retrieve the misfortunes of the day before.

Lord Jellicoe's Attitude.—Now, if the book is not a defence, what is it? It clearly has no parallel in literature save, perhaps, amongst the arresting records bequeathed to us by the simplicity of certain singular saints and the cynicism of a few exceptional sinners. Lord Jellicoe has, in short, set himself to the extremely difficult task of self-revelation; and he has succeeded to a very extraordinary degree. He has succeeded because he is calmly conscious that he has done his duty as he understood it, and, being perfectly confident of this, he is above consideration of fear or caution in telling the truth, the whole truth, and nothing but the truth. His is an act of faith in the sense of justice of his countrymen: the work of a man too proud to fight for a reputation which he knows to be completely unindictable on any ground of morals or of honor. He is too single-minded and too simple-minded to conceal a single motive or to misrepresent a single action. He seems to say to his readers—"I give you the story as it happened: I show you my mind at work. If I am wrong, it is because I acted on wrong principles; but I am not conscious of it. I leave my character in your keeping."

It is, then, impossible to close this book without an intense sense of the magnanimity and generosity of the writer. If there is a case against him, he has given it away quite hopelessly. It is precisely because of his conviction that there is no case that makes it so hard to insist that there is. But the obligations of intellectual integrity remain, even when it would seem that there is nothing left to fight for, and nobody to fight with, for Lord Jellicoe has disconcerted his critics by the strangely effective device of disarming himself. These obligations bind, however, because while Lord Jellicoe's book shows his motives from first to last to be of the highest, and his character to be above and beyond the least possibility of disparagement, the effect of his appeal to the public must be considered. Judging from the reviews, the book is taken to justify not only the writer—which it should—but the policy and the theory of war which he represents, which it should not. It is possible that this may be only a passing mood—the natural reaction of the confiding candor of this appeal. But whether this is so or not it seems obligatory to say that if national interests are to be served a true and not a false impression must be deduced from these pages.

The paradox of the position, of course, is that Lord Jellicoe tells the same story as his critics—with a wealth of proof to which none of them

United States to Italy are said to amount to $60,000,000 monthly, while the relief of the Czechs, Jugoslavs, and Serbians costs almost $20,000,000 monthly.

PROPOSED MILITARY AND NAVAL TERMS

At the session of the War Council on March 10 Marshal Foch was generally triumphant in having his conditions accepted. Some important changes were made, however, one of which imposes severer conditions than even Foch proposed.

It was premier Lloyd George who offered this. He asked that the German Army strength should be fixed at 140,000 men. As a result of discussion, it was agreed to fix the army strength at 100,000, or less than half the original maximum recommended under the terms laid down by the Allies.

Germany must raise this force by voluntary enlistment. In order to prevent an army of this size being trained every year, it was provided that the enlistments should be for a period of twelve years. The number of German officers is fixed at 4000, instead of the 6000 as originally contemplated.

All artillery and other equipment in excess of the requirements of the reduced army must be surrendered, and the Imperial General Staff must be abolished.

Other military provisions require the destruction of the Rhine forts and the reduction of the munitions output to the needs of the reduced army.

The naval terms, among other provisions, require the personnel of the German Navy to be restricted to 15,000 men.—*N. Y. Times*, 11/3.

ARGUMENTS AGAINST SINKING GERMAN BATTLESHIPS.—Prior to President Wilson's return to France, a letter said to have been written by him was published in which he expressed tentative disapproval of the proposal to sink the surrendered German battleships. After his return to Paris, however, he again took up the question. The arguments in favor of sinking the ships are summarized as follows by C. H. Grasty (*N. Y. Times*), March 17:

1. In the face of the covenant committal to decreased armament, distribution makes an immediate increase of 30 per cent in allied armaments.
2. As matters stand the American ability to put through a building program creates the possibility of inducing Great Britain to join her in the alternative of scaling down to the lowest point the number of ships consistent with self-protection and maintaining the League, whereas distribution will make new standards to be built up to.
3. Distribution will vastly and unnecesarily increase the burden of taxation.
4. World interests would be subserved by no one power controlling the seas against all comers.
5. The morale of the world requires a dramatic heralding of better days. Distribution is a step in the opposite direction.
6. Destruction preserves entire our moral position with respect to Germany.
7. American interests compel the acceptance of a joint naval burden with Great Britain. Distribution will make that burden too great for America to carry.
8. Finally if the German fleet is thrown among the Allies to be contended for as a prize, it will prove a veritable apple of discord that may make its surrender profit to Germany more than if she had risked her ships in a final battle. The division of naval spoils would be a negation of the principle of co-operation which is the foundation stone of the League.

CABLE CLAIMS DISPUTED.—Early in the war the British cut the two German cables from Emden to America by way of the Azores and also the cable between Monrovia, the Liberian capital, and Brazil. They took one end of the German-American cables to Halifax, thereby securing another transatlantic line for themselves. The other cable they gave to the French Government, which so far has made no attempt to utilize it, probably because of the scarcity of submarine cable material and of cable-laying ships.

The British now contend that these cables are prizes of war. They do not intend to allow their return to Germany or to regard them as subject to disposition by the Peace Conference. The American delegates, however, contend that the cables were unlawfully cut and unlawfully reconnected, because the United States was not at war when this was done and had an interest in them as being one of the termini. Nor, they contend, was there proper warrant for the cutting of the cable between Liberia and Brazil, as both these countries were neutral at the time it was done.

There never has been any decision regarding the title to cables outside of territorial waters in time of war, and the Americans are now extremely anxious that no precedent shall be established that might place American business at the mercy of foreigners or prevent free communication between the United States and Central Europe after the conclusion of peace.

In addition to the transatlantic cables, several German cables in the Pacific also were seized by the British as prizes of war. One of these runs from the island of Yap, one of the Caroline group, to Singapore, connecting with the Dutch and British cables. Another connects this cable with the island of Celebes. Possession of these lines, it is held, insures business control of a fair proportion of Australian Polynesia, which is regarded as properly within the field of American commercial effort.

The possibility of these cables passing in some degree under the control of Japan alone in case the latter is made the mandatary of the captured Pacific Islands is also regarded with disfavor by the American representatives unless some plan to prevent any possible discrimination is made.—*N. Y. Times*, 13/3.

SMALL STATES SEEK AMERICAN CONTROL.—The project of making the United States mandatary for one or more of the small states to be established in the Near East has been frequently broached at the Peace Conference. The proposed Armenian state, for which American control has been especially suggested, will probably have a population of about 6,000,000, in a territory bordering the Black Sea for 400 miles and extending southward nearly across Asia Minor. Mr. Oscar Straus, former Minister to Turkey, said in reference to this proposal:

> The United States must never take a mandate for any of these new or small states in Europe or Asia Minor. It would involve us in endless trouble.

PREMIER CLEMENCEAU WOUNDED BY ANARCHIST.—On February 19, Premier Clemenceau was hit by three of seven shots fired by an assassin. One bullet entered the right shoulder and lodged under the left shoulder missing the spinal cord and lungs; the other two caused little more than abrasions of the skin. The attack occurred at 8.55 a. m. just after the Premier had entered his automobile to drive from his home to the Foreign

Office. The assassin, an anarchist, 18 years old, named Emile Cottin, was arrested and on March 14 sentenced to death.

The aged Premier made an astonishingly rapid recovery, taking up his public duties again in scarcely more than a week.

LEAGUE OF NATIONS DISCUSSION IN THE UNITED STATES

PRESIDENT WILSON'S BOSTON SPEECH.—Landing in Boston upon his return from France, President Wilson on February 24 spoke vigorously in that city in advocacy of the project for a League of Nations. "In the name of the people of the United States," he declared, "I have uttered as the objects of this great war ideals, and nothing but ideals, and the war has been won by that inspiration." Arguing the necessity of a League of Nations, he said:

If America were at this juncture to fail the world, what would come of it? I do not mean any disrespect to any other great people when I say that America is the hope of the world; and if she does not justify that hope, the results are unthinkable. Men will be thrown back upon the bitterness of disappointment not only, but the bitterness of despair. All nations will be set up as hostile camps again; the men at the Peace Conference will go home with their heads upon their breasts, knowing that they have failed—for they were bidden not to come home from there until they did something more than sign a treaty of peace.

Suppose we sign the treaty of peace and that it is the most satisfactory treaty of peace that the confusing elements of the modern world will afford, and go home and think about our labors, we will know that we have left written upon the historic table at Versailles, upon which Vergennes and Benjamin Franklin wrote their names, nothing but a modern scrap of paper; no nations united to defend it, no great forces combined to make it good, no assurance given to the downtrodden and fearful people of the world that they shall be safe.

Any man who thinks that America will take part in giving the world any such rebuff and disappointment as that does not know America. I invite him to test the sentiments of the nation. We set this up to make men free, and we did not confine our conception and purpose to America, and now we will make men free. If we did not do that, the fame of America would be gone, and all her powers would be dissipated. She then would have to keep her power for those narrow, selfish, provincial purposes which seem so dear to some minds that have no sweep beyond the nearest horizon.

I should welcome no sweeter challenge than that. I have fighting blood in me, and it is sometimes a delight to let it have scope, but if it is a challenge on this occasion it will be an indulgence. Think of the picture, think of the utter blackness that would fall on the world. America has failed! America made a little essay at generosity, and then withdrew. America said, "We are your friends," but it was only for to-day, not for to-morrow. America said, "Here is our power to vindicate right," and then the next day said, "Let right take care of itself, and we will take care of ourselves." America said, "We set up a light to lead men along the paths of liberty, but we have lowered it; it is intended only to light our own path." We set up a great ideal of liberty, and then we said: "Liberty is a thing that you must win for yourself. Do not call upon us."

And think of the world that we would leave. Do you realize how many new nations are going to be set up in the presence of old and powerful nations in Europe, and left there, if left by us, without a disinterested friend?

foundry, boiler and blacksmith shop, coppersmith shop, pipe and sheet metal shop, pattern shop, and carpenter shop, electrical shop, drafting room, optical shop, and gyro-testing room. The repair ship is about 484 feet long over all with a beam of 70 feet and draft of 19 feet, displacing about 10,000 tons. The battery consists of four 5-inch guns and four 3-inch anti-aircraft guns.

The transport has been designed after a careful study of the service of the present transport, *Henderson*, during the European war. It is essentially a duplicate of the *Henderson* with such changes as were considered advisable as a result of war experience; like the *Henderson* it has been designed for the purpose of transporting an expeditionary force of marines together with their advance base outfit and equipment. The principal dimensions are: Length, 484 feet; beam, 64 feet; draft, 19 feet 6 inches; displacement, about 10,000 tons. The battery will consist of four 5-inch guns, two 1 pounder guns, two 3-inch anti-aircraft guns, and two 6-pounder guns.

Both the repair ship and the transport will be propelled by the customary steam turbines, operating through reduction gearing. The vessels have been designed for a speed of 16 knots per hour. Both vessels will be equipped with high-power radio outfits.—*Naval Monthly*, March.

NAVAL POLICY

DANIELS TO CONFER ON IDEAL WARSHIP.—Secretary Daniels and a party of American naval experts will leave for Europe next week to discuss with allied officials the best type of capital warships to be built in the future, based on the lessons gained in the great war. Because of conflicting opinions on this subject among American officers the Secretary has been asked to submit a definite recommendation to the next Congress in December.

Secretary Daniels will be accompanied by Rear Admirals Taylor, Chief of the Bureau of Construction and Repair; Griffin, Chief of the Bureau of Steam Engineering; Earle, Chief of the Bureau of Ordnance, and Commander Foote, his personal aid. The party will be joined overseas by Admiral Benson, Chief of the Bureau of Operations, who is attached to the American Peace Delegation, and Vice Admiral Sims, commanding all the American naval forces in European waters.

Mr. Daniels and his party will sail from New York on the transport *Leviathan* and will go first to Paris to confer with the French Admiralty. Later they will visit London and Rome and probably will be away a month or more.

While deductions to be drawn from war experiences on all subjects will be discussed in detail, the American Naval Mission will address itself particularly to the question of future types of capital ships. It has been the judgment of the Navy General Board, charged with fixing the military characteristics of new ships, that the United States should continue to build dreadnoughts of constantly increasing power and battle cruisers. This view is held by Rear Admiral Fletcher, chairman of the General Board and former commander of the Atlantic fleet.

Admiral Mayo, now commander of the Atlantic fleet; Vice Admiral Sims and Rear Admiral Rodman, the three officers who have held the highest posts of the American service in the war zone, believe, however, that a composite ship, combining the speed of a battle cruiser with the gun power and armor of a battleship, should be substituted. These officers have been particularly impressed by British experiments toward a composite craft with the construction of the *Hood*, one of the so-called British "hush" ships.

Secretary Daniels has not taken sides in the dispute, nor have his three chief technical advisers, the men who will design and construct whatever

Now, therefore, be it resolved, by the Senate of the United States in the discharge of its constitutional duty of advice in regard to treaties, that it is the sense of the Senate that while it is the sincere desire that the nations of the world should unite to promote peace and general disarmament, the constitution of the League of Nations in the form now proposed to the Peace Conference should not be accepted by the United States.

THE PRESIDENT'S NEW YORK SPEECH.—On March 4, on the eve of his return to France, President Wilson spoke at the Metropolitan Opera House in New York. Without entering into a detailed defence of the League Covenant, the President declared that he was amazed at the ignorance regarding the state of the world displayed by its opponents.

"I have heard," he said, "no constructive suggestion, I have heard nothing except 'will it not be dangerous to us to help the world?' It would be fatal to us not to help it." He added that, far from involving us in entangling alliances, the League is "an arrangement which will disentangle all the alliances in the world." The President declared his confidence that the sentiment of the country was behind him.

EX-PRESIDENT TAFT SUPPORTS LEAGUE.—The speech of President Wilson in New York was preceded by an address by ex-President Taft, in which he met in detail the arguments against American support of the League. Mr. Taft declared that our danger from foreign combinations would be greater without the League than with it; that the League covenant contained no provision preventing a country from resisting invasion, such as a border raid from Mexico; that the furnishing of military force to support League decisions would be voluntary rather than compulsory; that the covenant created no super-sovereignty; and that a treaty agreement limiting the power of Congress to make war or to increase armaments was constitutional, as shown by many precedents, such as the agreement with Great Britain not to fortify the Canadian frontier.

Mr. Taft, suggested that there should be some provision in the League plan for withdrawal from the League after reasonable notice. Appropriate words he thought might also be added to show that troubles in any continent would be the primary concern of nations of that continent, or hemisphere. This he considered clearly implied, but its explicit statement would relieve anxiety about European or Asiatic interference in America.

GERMANY

BAVARIAN PREMIER MURDERED.—Kurt Eisner, the Independent Socialist Premier of Bavaria, was shot on the streets of Munich on February 21. The assassin was Count Arco Valley, a Bavarian aristocrat and former officer. The murder was reported to be due to Eisner's exposure of the war guilt of the German military authorities and their inhuman treatment of prisoners of war, made at the Berne Socialist Congress, together with his later statement in Munich that he had documentary evidence to prove that the German general staff continued, even then, to carry on secret dealings with the Russian Reds.

According to the statement of a Geneva correspondent of the *N. Y. Times*, on February 25, ex-Crown Prince Rupprect of Bavaria returned from Switzerland to Bavaria on the day after this declaration by Eisner, and his return was probably connected with the event that followed. On the night preceding the assassination, several officers of the Bavarian Light Guards, in which Valley served, met and tossed dice to decide which should murder the Premier.

The murder was at once utilized by Bavarian Sparticides. When Herr Auer, Minister of the Interior, arose in the Diet to announce the murder of Eisner, a volley was fired from the gallery, seriously wounding the Minister and one of the deputies on the floor of the House. The Munich Central Council of Workmen and Soldiers took control, however, and on February 24 elected a provisional ministry including a majority of Moderate members—four Majority Socialists, three Independent Socialists, one member of the Peasant party and one Bourgeois. The Sparticides were thus barred out, and the government undertook concentration of troops to suppress their activities. On March 8 it was announced that the Diet would be convoked, in the expectation that it would confirm the new Socialist ministry.

BERLIN RIOTS.—On March 3 a general strike was declared in Berlin. All traffic stopped, and the city for a time was without water, electricity or gas. The strike was the result of a resolution passed on March 2 by the Workers' Council of Berlin by a bare majority over the Moderate members. Various armed bands, such as the "People's Republican Guard" and "Marine Guard" were organized by the Sparticides to carry out a reign of terror.

Government troops at once closed in on the rebel forces, besieged their strongholds, and by the end of the week controlled the city, with the exception of certain suburbs. On March 8 the Majority Socialists of the Berlin Workmen's Council bolted and declared the strike off.

The later fighting during the week March 9–15 was marked by increasing savagery on both sides. As a result of Sparticide atrocities, Herr Noske, Secretary of Military Affairs, on March 10 declared no quarter to rebels captured with arms. An estimate of March 17 placed the number killed on both sides at over 1000; and the damage at over 40,000,000 marks.

RUSSIA

BALTIC PORTS TAKEN FROM REDS.—The ports of Libau and Windau, in Courland on the Baltic Sea, which were taken by the Bolsheviki on January 31, have been recaptured.

Windau was retaken by the Germans by a simultaneous land and sea attack after a violent battle, according to a Berlin dispatch.—*N. Y. Times*, 27/2.

WORK OF BOLSHEVIKI FORCES.—The Moscow general staff claims that in January and February the Red army reoccupied territory as large as France, with 1055 miles of railway. The Red army, adds the communique, will reach Archangel May 1.—*Washington Post*, 15/3.

POLAND RECOGNIZED BY ALLIES.—On February 21 formal announcement was made by the Supreme Council in Paris that the Allies would extend recognition to the Polish Government headed by M. Paderewski. On March 5 an Interallied Commission left Paris to arrange new armistice terms between the Germans and Poles. At a meeting of the Polish National Assembly on February 20 General Joseph Pilsudski was again made Chief of State, subject, however, to the will of the Assembly.

FAR EAST

KOREAN INDEPENDENCE AGITATION.—Independence demonstrations verging on revolt occurred in Korea during the first week of March. Thousands of demonstrators were arrested, and the Japanese soon had the movement under control. According to a Shanghai dispatch of March 14, upwards of 100 persons were killed in rioting.

President Wilson, according to a Washington dispatch of March 16, was asked by the Korean National Association to initiate action at the Peace Conference looking toward the independence of Korea, under a mandatory issued by the League of Nations.

JAPAN AND THE PACIFIC ISLANDS.—Japan has no moral right to possession of the South Sea Islands taken from Germany and now under Japanese occupation, nor is any other nation entitled to ownership of this territory, according to Professor Sakuzo Yoshino, of the Tokyo Imperial University, who, in *The Japan Advertiser* of that city, suggests a plan for control of the islands that is practically the same as President Wilson's, namely, that they should be placed in charge of a League of Nations or an Interallied commission responsible for the education of the natives until they become civilized and competent to settle for themselves all questions of their future. If Japan should be this guardian, it is predicted, the islands might eventually be annexed to Japan. An official outline of Japan's intentions is given in Paris cables by Baron Nobuaki Makino, senior Japanese delegate to the Peace Conference, who says of the Marshall and Caroline groups of islands, peopled by wild and practically savage tribes, that Japan claims the right to "occupy these islands for purposes of peaceful development." Japan contends, and will continue to contend, that she shall control the islands north of the equator, and it is her conviction that "the handing over of the supervision of these islands would be a just recognition of what services we rendered in maintaining the commerce of the Pacific and assisting our allies in the Indian Ocean and the Mediterranean." An official statement of Australia's views is given in Paris also by Premier William M. Hughes, who maintains that of the former German island possessions Australia claims full control of all lying below the equator, except Samoa, which should go to New Zealand, and that part of New Guinea which is in Dutch possession. What Australia wants is a settlement of the Pacific island question by the Peace Conference, the Premier is further quoted as saying, "such as she is entitled to have, one that will insure her national safety and guarantee her industrial, social, and racial policies." Australia prefers not to accept the mandate principle, but if compelled to do so "it is imperative that we must make the same laws and have over the new territories the same powers as we exercise over Australia.

Professor Yoshino foresees a competition in colonial policies among the Powers entirely different from that of the past. The fundamental feature in this competition will be the education of the people in the colonies so that they become competent to manage their own affairs. Formerly, we

are reminded, rivalry among the Powers in the development of colonies was based on the building up of commerce and industry. Under the new order of things, he points out that—

"If Japan be able to educate the inhabitants of the South Sea Islands rightly, giving them such civilization as to make them self-governing, when the time comes that other Powers recognize the ability of the inhabitants to determine their own future they declare that they are desirous of becoming part of Japan, to which they owe their civilization and prosperity, Japan will properly be able to say that she made a great success. I am thinking always that the colonial policy of Japan, as well as that of all other Powers, should be changed as the result of the war, and in this respect I am confident that the questions arising regarding the settlement of the German colonies will prove helpful in bringing the Powers over to a new method and a new principle in their colonial policies."—*Literary Digest, 22/2.*

THE INDUSTRIAL PROGRESS OF JAPAN

An article in *Engineering* (London, February 21) gives an extended and highly interesting account of Japanese railroad and industrial development in the present century, during which she has grown into a great industrial nation, competing with western powers for the markets of the east. The latter part of the essay, dealing with Japan's advance into China, is as follows:

That Japan would eventually reach a state of industrial independence was without doubt to be expected, but her industrial domination of China was not; and yet it is possible, for the Japanese Government is doing everything it can to secure it. Thus Finance Minister Shoda in May, 1918, in an address to a general meeting to the bankers of Western Japan, emphasized the need for independent sources of supply for necessaries and expressed dissatisfaction at the amount of Japanese money invested in China although this amounted to 9,800,000*l*. in the year 1917 alone, not quite as much as Japan's total investment in the country previous to the war. He also said that for the encouragement of investment abroad, the government had decided to guarantee principal and interest to the amount of 10,000,000*l*. in the Industrial Bank of Japan. This is sufficient indication of the government attitude, and the further increase of Japanese power in China is to be feared for the following reasons, which give very little hope of the maintenance of the Open-Door policy under a dominant Japan.

Thus in the leased territory in Manchuria and in her colonies Japan has always stifled all competition either by high preference rates or by methods more questionable, as in Manchuria, where Chinese banks are compelled to cash a full face value note depreciated to the amount of 40 per cent or over, if presented by Japanese nationals.

Methods like these, coupled with the notorious partiality of Japanese law courts, whether consular or otherwise, effectually discourage competition even without the fear that any competing business would not be killed immediately by transport difficulties on Japanese-controlled railways.

Further no selection has been enforced by the government in the matter of emigrants, with the consequence that the name of Japan is continually being discredited in China by undesirables who seem to form the bulk of Japanese emigrants, judging from the disreputable trades engaged in and the low standard of their trade morality.

In addition, the government itself has at least laid itself open to the suspicion of fostering the continuance of the disastrous and wasteful war between North and South China, which has been going on since 1916, for she has lent money wholesale to North China, well knowing that there

COMMUNICATIONS IN THE FAR EAST.

was at least considerable doubt about the loans ever being used for their ostensible purposes. Among the most notorious of these loans was the Arms loan of 1917 for 4,000,000*l*., said to be for the equipment of the Chinese expeditionary force for the European war, but without doubt in part used for the purchase of war material for the war against the South. Among other exceedingly questionable loans may be enumerated the Telegraph loan, previously mentioned, the proceeds of which were undoubtedly used for the war, a loan of 300,000*l*. to the rebel southern government in February, 1917, secured on the Canton cement works, a further loan of 200,000*l*. to the rebel southern governor of Hunan secured on iron mines in Anhui and antimony mines in Hunan, and lastly a loan known as the Military loan of unknown amount, said to be 4,000,000*l*., the terms of which are secret, but are supposed to provide for the military reorganization of China under Japanese supervision.

Summarizing the above we find the British manufacturer confronted with the almost total loss of the Japanese market, worth over 12,000,000*l*. in 1912 and then on the increase, and also with a very clever competitor in what promises to be one of the world's greatest markets. Further this competitor has the great advantage of proximity, strong government backing both moral and financial, very low wages and a standard of living infinitely below ours, and last but not least a laxity of trade morals, coupled with great tenacity of purpose. It should also be remembered that since the war Japan has entered the market against us in almost every branch of Western industry, that their goods are at any rate extremely attractive, and have, in some cases, particularly as regards electrical goods and cement, proved very satisfactory, though in the great majority of cases they are inferior in quality, a defect largely counterbalanced by their cheapness, which appeals irresistibly to the half-trained mind.

Japanese industrial strength lies in organizing and imitative ability, her adequate finance of industry which insists on getting the best and most up-to-date even if of foreign origin, and her supply of cheap labor, even in the case of the skilled artisan class.

Japan's weakness lies in her lack, amongst some classes, of that high standard of trade morality which is so necessary to establish credit and reputation, her mineral poverty, her dependence on outside sources for much of her food supply and all her wool supply, and the popular dislike of immigration, for out of 55,000,000 people, only 500,000 are resident abroad, while very many of these are undesirables.—*Engineering (London)*, 21/2.

REVIEW OF BOOKS
ON
SUBJECTS OF PROFESSIONAL INTEREST

"Ship Stability and Trim." By Percy A. Hillhouse, B. Sc. M. I. N. A., 297 pages. Price $4.50 net. (London: John Hogg, 13 Paternoster Row, 1918. Distributors, D. Van Nostrand Company, New York.)

The author has summed up the scope and purpose of this book in the Foreword as follows:

"The aim of the writer of the present volume has been to treat the problems of stability more fully than is possible in a work covering the whole range of Naval Architecture, while avoiding the more deeply mathematical portions of the subject and considering its practical rather than its theoretical aspects.

"A knowledge of the elements of stability is of primary importance in both naval and mercantile services. The Board of Trade has now included the subject in their examinations for masters, and it is hoped that *Ship Stability and Trim* will prove to be of practical value to all who have to do with the designing, loading, or ballasting of ships or other floating bodies."

While the author states that he has avoided the more deeply mathematical portions of the subject of stability no one will quarrel with the lack of mathematics in Chapter IV, where he deals with the height of metacenter in bodies of simple form. The reader may, however, omit this portion of the book without seriously impairing its value for imparting knowledge on the subject of ship stability. The mathematics throughout is made so simple and is illustrated by such understandable diagrams that anyone with a working knowledge of arithmetic should be able to grasp the underlying theory of stability therefrom. The author is particularly happy in his explanation of moment inertia in Chapter IV.

The effect of wind on stability is given a well-deserved chapter. In these days of increasing freeboard of merchant vessels the influence of wind pressure on the stability curve is of considerable importance.

An interesting and instructive chapter is devoted to free water, with a discussion on the relative merits of longitudinal and transverse subdivision, and an explanation of the reasons which led the International Convention for the Safety of Life at Sea to give preference to transverse watertight subdivision.

The portion of Chapter IX which is devoted to the subject of stability when docking is particularly valuable because this subject is generally not touched upon in works on Naval Architecture. The author explains very clearly how, by the use of the displacement and stability data furnished

by the builders, calculations can be made to determine whether a condition of instability will result when the vessel lands on the blocks. It is to be regretted that the author did not add a chapter on stability and trim conditions when a vessel lies stranded in various positions. Salvage operations can frequently be hastened and can usually be given an extra chance of success by careful study of these conditions. However, the discussion on stability when docking covers the theory which should be applied to the stability of a stranded vessel.

The book admirably serves the purpose for which it was written.

J. A. F.

"Marine Gas Engines." By Carl H. Clarke. (Published by D. Van Nostrand Company.)

This book describes the construction and principles of operation of the various standard types of gas and oil engines in plain and simple language so that it may be easily understood by anyone interested in power obtained by the internal combustion of gas and oil fuels. As its title implies, the volume is intended primarily for the users of marine gas engines. No attempt is made to deal with the subject matter from a theoretical or thermodynamic standpoint. It is well illustrated and arranged and has been brought up to date by the addition of material on oil and Diesel engines in accordance with recent developments along these lines.

The book is divided into 15 chapters, of which Chapter V on Ignition Devices is very complete and will prove to be a valuable assistance to all operators who desire to master this source of trouble.

On the whole the book covers its field in a capable manner and although the author does not describe the particular types of machines in use in the naval service, he covers the methods and principles of operation thereof so that it should find a wide field in the service, due to the fact that the writer covers the topic in a style that will satisfy all inquiring minds on the subject of the construction and management of marine gas engines.

W. L. L.

"The British Navy in Battle." By A. H. Pollen. Price, $2.50. (New York: Published by Doubleday, Page & Co.)

CHAPTER I. A GREETING BY WAY OF DEDICATION

Mr. Arthur Pollen commences his work by a glowing tribute to the officers and men of the Royal Navy. In his opinion the British Admiralty was faultily organized and carried out an inefficient policy; these mistakes, however, were more than counterbalanced by the thoroughness and efficiency of the officers and men of the navy at sea face to face with the enemy. But let Mr. Pollen speak for himself:

"Take it all in all, never in the history of war has organized force accomplished its purpose at so small a cost in unpreventable loss, or with such utter thoroughness, or in face of such unanticipated difficulties.

"It was inevitable that there should be some failures. Not every opportunity has been seized, nor every chance of victory pushed to the utmost. Who can doubt that there are a hundred points of detail in which your material, the methods open to you, the plans which tied you, might have been more ample, better adapted to their purpose, more closely and wisely considered? For when so much had changed, the details of naval war had to differ greatly from the anticipation. In the long years of peace—that seem so indefinitely far behind us now—you had for a generation and a half been administered by a department almost entirely civilian in its spirit and authority. It was a control which had to make some errors in policy, in provision, in selection. But your skill counterbalanced bad policy when it could; your resources supplied the defects of material; too few of you were of anything but the highest merit for many errors of selection to be possible.

"And the nation understood you very little. Your countrymen, it is true, paid you the lip service of admitting that you stood between the nation and defeat if war should come. But war seemed so unreal and remote to them, that it was only a few that took the trouble to ask what more you needed for war than you already had.

"And you were too absorbed in the grinding toil of your daily work to be articulate in criticism; too occupied in trying to get the right result with indifferent means—because the right means cost too much and could not be given to you—to strive for better treatment; too wholly wedded to your task to be angry that your task was not made more easy for you. Hence, you took civilian domination, civilian ignorance, and civilian indifference to the things that matter, all for granted, and submitted to them dumbly and humbly, as you submitted silent and unprotesting to your other hardships; you were resigned to this being so; and were resigned without resentment. If, then, the plans were sometimes wrong, if you and your force were at other times cruelly misused, if the methods available to you were often inadequate, it was not your fault—unless, indeed, it be a fault to be too loyal and too proud to make complaint."

CHAPTER II. A RETROSPECT

This chapter was written in August, 1918, and in it Mr. Pollen makes a broad survey of the war on the sea as carried out up to that time. After calling attention to the fact that reversals in the land warfare had been frequent and startling, he shows that the various crises which occurred in the war on the sea, while fewer in number, were more extreme: "This has not been the case at sea. The transformations here have been fewer; but they have been extreme. For two and a half years the sea power of the Allies appeared so overwhelmingly established and so abjectly accepted by the enemy, that it seemed incredible that this condition could ever alter materially. Yet between the months of February and May, 1917, the change was so abrupt and so terrific that for a period it seemed as if the enemy had established a form of superiority which must, at a date which was not doubtful, be absolutely fatal to the alliance. And, again, in six months'

time, the situation was transformed, so that sea power, on which the only hope of allied victory had ever rested was once more assured."

Mr. Pollen then proceeds to trace the four great crises of the war on the sea. During August, 1914, the British command of the sea had seemed complete. But soon the tide seemed to be turning in the favor of the Germans and doubt began to creep into British minds as to whether the British Navy could retain the supremacy. Let Mr. Pollen describe the situation:

"During September an accumulation of errors came to light. The enormity of the political and naval blunder which had allowed *Goeben* and *Breslau* to slip through our fingers in the Mediterranean, and so bring Turkey into the war against us, at last became patent. There was no blockade. There were the raids which *Emden* and *Karlsruhe* were making on our trade in the Indian Ocean, and between the Atlantic and the Caribbean. The enemy's submarines had sunk some of our cruisers—three in succession on a single day and in the same area. Then rumors gained ground that the Grand Fleet, driven from its anchorages by submarines, was fugitive, hiding now in one remote loch, now in another, and losing one of its greatest units in its flight. For a moment it looked as if the old warnings, that surface craft were impotent against under-water craft, had suddenly proved true. Von Spee, with a powerful pair of armored cruisers, was known to be at large. As a final insult, German battle cruisers crossed the North Sea, and battered and ravaged the defenseless inhabitants of a small seaport town on the west coast. Something was evidently wrong. But nobody seemed to know quite what it was."

These events caused the first crisis. Prince Louis of Battenburg was relieved from his post as First Sea Lord and Lord Fisher appointed in his place. The situation now changed as if by magic. *Emden* was destroyed; Von Spee's squadron, with the exception of *Dresden*, was sunk; *Karlsruhe* disappeared and finally, in the battle of the 24th of January, Hipper was driven back with the loss of the cruiser *Blucher*. The Churchill-Fisher administration at the Admiralty was apparently completely successful. But this success was not caused by any efficiency of the Admiralty administration. The loss of *Karlsruhe* was a pure accident. The destruction of *Emden* was an event which had to come sooner or later. It is true that Lord Fisher gains the credit for the sending of the battle cruisers to the Falkland Islands in search of Von Spee, but the instant success of Sturdee's mission was merely an astonishing piece of luck. The battle of the 24th of January was really far from creditable to the British, as Mr. Pollen shows in his detailed description of this action.

The second crisis soon took place. The Germans commenced their first submarine campaign against merchantmen in February, 1915. The naval attack upon the Dardanelles was a total and disastrous failure. The people began to see the real lesson of the escape of Hipper's cruisers. "The German battle cruisers escaped at Heligoland for exactly the same reasons that the attempt to take the Dardanelles forts by naval artillery was futile. We had prepared for war and gone into war with no clear doctrine as to what war meant, because we lacked the organism that could have produced

the doctrine in peace time, prepared and trained the navy to a common understanding of it and supplied it with plans and equipped it with means for their execution. What was needed in October, 1914, was not a new first sea lord, but a higher command charged only with the study of the principles and the direction of fighting." Mr. Churchill was relieved as first lord by Mr. Balfour and Lord Fisher was relieved by Sir Henry Jackson. Again the tide seemed to turn in favor of the British, for the submarine campaign died down in October, 1915, and although revived again in March, 1916, was stopped then by the threat of American intervention. The British supremacy was seemingly definitely proved by the results of the battle of Jutland, which showed to both the British and the Germans that the German High Seas Fleet could never gain the command of the seas.

But the unsatisfactory ending of this battle caused a great controversy. "The critics established themselves in two camps. One side was for facing risks and sinking the enemy at any cost. The other would have it that so long as the British Fleet was unconquered it was invincible, and that the distinction between 'invincible' and 'victorious' could be neglected. After all, as Mr. Churchill told us, while our fleet was crushing the life out of Germany, the German Navy could carry on no corresponding attack on us; and when the other camp denounced this doctrine of tame defense, he retorted that victory was not only unnecessary but that the torpedo had made it impossible.

"Yet, within two months of the battle of Jutland, the submarine campaign had begun again, and, at the time of Mr. Churchill's rejoinder, the world was losing shipping at the rate of three million tons a year. As there had never been the least dispute that to mine the submarine into German harbors was the best, if not the only, antidote, never the least doubt that it was the German Fleet that prevented this operation from being carried out, it seemed strange that an ex-First Lord of the Admiralty should be telling the world, first, that the German Fleet in its home bases delivered no attack on us and therefore need not be defeated! And, secondly, as if to clinch the matter and silence any doubts as to the cogency of his argument, we were to make the best of it because victory was impossible."

The German submarine campaign of the fall of 1916, therefore, brought on the third crisis. "Once more the old wrong remedy was tried. The government and the public had learned nothing from the revelation that we had gone to war on the doctrine that the fleet *need* not, and *ought* not, to fight the enemy, and were apparently unconcerned at discovering that it *could* not fight with success."

While Admiral Jellicoe came to the Admiralty as relief of Sir Henry Jackson the system remained unchanged. The situation grew worse rather than better. "Thus, without having lost a battle at sea—but because we had failed to win one—a complete reverse in the naval situation was brought about. Instead of enjoying the complete command Mr. Churchill has spoken of, we were counting the months before surrender might become inevitable. During the 10 weeks leading up to the culminating losses of April, a final effort was made to make the public and the government realize that failure of the Admiralty to protect the sea-borne commerce of a seagirt people was

due less to the government's reliance on advisers ill-equipped for their task, than that the task itself was beyond human performance, so long as the higher command of the navy was wrongly constituted for its task.

"But when reason and argument had been powerless to prevail, the logic of facts gained the victory. At last, in the fourth crisis of the war, it was realized that changes in personnel at Whitehall were not sufficient, that changes of system were necessary. Before the end of May the machinery of administration was reorganized and a higher command developed, largely on the resisted staff principle."

The principal result of the inauguration of the new system was the establishment of the convoy system which saved the situation as far as the submarines were concerned; but while the system had been changed the persons identified with all the previous failures and who were responsible for the methods and plans that had led to them remained in power. In January, 1918, however, Admiral Wemyss relieved Admiral Jellicoe as first sea lord and Sir Eric Geddes became first lord. From this point on the British naval policy was changed from a passive defensive to a strong offensive. Sir Roger Keyes was appointed to the Dover command and a mine barrage was laid across the Straits of Dover. At the same time another great mine-field was laid across the North Sea from Scotland to the Norwegian coast, and still another was laid in the Kattegat. A very successful raid was made into the Kattegat and Sir Roger Keyes carried out two splendid attacks on the German bases at Zeebrügge and Ostend. The entire situation had been changed and the old supremacy on the sea was definitely assured.

CHAPTER III. SEA FALLACIES

Mr. Pollen defines the ideas regarding the navy and sea power which were held by the British people. Among the many false ideas the two chief ones were the idea at the beginning of the war that battleships were everything, and the later idea that battleships were useless and that submarines were supreme.

"He was wrong then and he is wrong now. It was an error to think of sea power only in terms of battleships. It is a still greater error to suppose that sea-power can exist in any useful form unless based on battleships in overwhelming strength."

CHAPTER IV. SOME ROOT DOCTRINES

There were two schools of thought regarding the navy before the war. One was for the gaining of the decision by fighting. The other idea was to have such a superiority in strength as to gain the victory without having to fight. The later school predominated. According to Mr. Pollen "we showed that our policy was not to attack but to wait attack, and then not to do anything to compel the enemy to attack."

The ideas of the two schools are described by Mr. Pollen as follows: "But in recent history we have witnessed the curious spectacle that an inversion of the order of these two statements did actually create two

different and opposed schools of naval thought. The first school saw in victory the first and constant preoccupation of the fleet. It concerned itself, therefore, chiefly with the essentials to victory, and as victory can only come from fighting it was at the elements of fighting that it worked. It sought to find the most perfect methods of using weapons because it realized that it was only from the evolution of these that right tactics could be deduced. It studied the campaigns of the past to discover the two great groups of doctrines that our fighting ancestors have bequeathed to us, the first dealing with the science of strategy, the second with the principles of command. They realized that weapons and the ships that carry them do not fight themselves but must be fought by men; and they wished those men rightly educated and trained in the subtle and complex science of their high calling. To them, in short, sea war was an affair of knowledge applied by men trained both in the wisdom and in the lofty spirit of those that had excelled in the naval war before. And, faithful to the traditions of the past, no less than eager for research into all the undeveloped potentialities of the products of modern progress, they pinned their faith on their ability to force the enemy to battle, and to beat him there when battle came.

"The other school went for a short cut to naval triumph. If only they could get a fleet of ships so big, so fabulously armed, so numerous as to make it seem to the enemy that his fleet was too feeble to attack, why then battle would be made altogether superfluous, and no further worry over so unlikely a contingency was necessary. They did not, therefore, trouble to inquire either into the processes needed for bringing battle about, or into what was necessary for success when battle came. They passed on to the contemplation of what can only be the fruit of victory—as if victory were not a condition precedent!

"It was, unfortunately, this group, hypnotized by a theory it did not understand, which controlled naval policy in Great Britain for the 10 years preceding the war, and for the first three and a half years of it. Their error lay, of course, in supposing that a fleet, so materially strong and numerous that its defeat was unimaginable because no attack on it could be conceived, must—so long as any serious lowering of its force by attrition was avoided—be the military equivalent to one which had already defeated the enemy; that 'invincible' and 'victorious' were, in short, interchangeable terms. So masterful was this obsession that their apologists—shutting their eyes to the obvious and appalling consequences of this creed in action—two years after the event, still regarded the only encounter between the main fleets in this war as a great victory, because the larger, by avoiding the risk of close contact with the lesser, came out of the conflict with forces as substantially superior to the enemy's as they were before the opportunity of a decisive battle had been offered."

CHAPTER V. ELEMENTS OF SEA FORCE

In this chapter Mr. Pollen describes the policy of the Admiralty in more detail. In 1909 the war staff was instituted but was never given real power.

"But the war staff was never put into the position to discharge the functions which the 1909 committee had designated as its main purpose. So

far from being an authority equipped for the exhaustive study of war and how to prepare for it, the whole apparatus of fighting was carefully excluded from its purview. It had no connection with the departments administering gunnery, torpedoes, submarines, aircraft, or mines. As to some of these activities, there were as a fact no departments solely charged with their control before the war staff was instituted. They were not entrusted to the war staff. And no new staffs were created! If the strategical vagueness, to which the Beresford committee had borne witness in 1909, arose largely, as many supposed, from the uncertain state of naval technique, then, so far as the war staff was concerned, this vagueness had to continue—for technique was not their concern."

After discussing the proper naval strategy for the battle fleet and the submarines, Mr. Pollen says:

"Thus, if there was one form of offensive imperatively imposed on us, it was that of naval artillery; and if there was one form of defensive not less imperatively incumbent, it was the provision of adequate protection against submarines.

"It is now, of course, common knowledge that it was exactly in these two particulars that Admiralty policy from 1904–1914 was either discontinuous, vacillating, and self-contradictory, or simply non-existent. So far as it cultivated anything, it was a defensive tactics for the gun and offensive tactics for the submarine!"

CHAPTER VI. THE ACTIONS

The author now gives a rapid summary of the actions fought during the war and brings out the fact that there was no tactical doctrine in the British Navy. He lays special emphasis upon the strongly contrasted tactics of Beatty and Jellicoe at the battle of Jutland.

"There is no getting out of this dilemma. If Admiral Jellicoe was right in refusing to face the risks inseparable from a resolute effort to make the battle decisive, then Sir David Beatty must have been wrong to have fought in a way which cannot be intelligently explained except on the basis that from first to last he had decisive victory as his object. If the tender care that brought the Grand Fleet through the action with hardly a man killed and only two ships touched was right and wise, then the clear vision, all the more luminous for seeing and counting the cost, which exposed *Indefatigable, Queen Mary,* and *Invincible* to destruction, was woefully wrong. Now it seems extraordinary, if the strategy of waiting to fight till the Germans attacked was right—if this was the Admiralty doctrine—that it was not communicated to Sir David Beatty as well as to Sir John Jellicoe. If it was axiomatic to avoid the risk of ships being destroyed, so that Admiral Moore was right to break off the action at the Dogger Bank and Admiral Jellicoe right in letting the enemy 'open the range under the cover of torpedo attacks,' why was not Admiral Beatty forbidden to jeopardize his ships, and Admiral Arbuthnot warned against any pursuit of the enemy's cruisers or destroyers, that might possibly bring him within range of the German gunfire? How are we to explain Bingham's attack on the head of the German line or Goodenough's recon-

naissance which brought him under the salvoes of the German guns at 12,000 yards? Is the doctrine of caution and ship conservation to apply only to battleships and not to battle cruisers, armored cruisers, light cruisers, and destroyers? Is it only the battle fleet that is not to fight except when it risks practically nothing by doing so? All these questions are forced to the student's attention when he reviews the events here recorded."

CHAPTER VII. NAVAL GUNNERY, WEAPONS AND TECHNIQUE

In this chapter Mr. Pollen gives a clear description of naval gunnery and torpedo fire intended for the civilian reader.

CHAPTER VIII. THE ACTION THAT NEVER WAS FOUGHT

In a comparison of forces at the beginning of the war Mr. Pollen allows the British 20 dreadnoughts and 4 battle cruisers ready for sea—failing to count 3 battle cruisers in the Mediterranean, 1 in a dockyard and 1 in the Pacific. The Germans were allowed 15 dreadnoughts and 4 battle cruisers ready for sea. He, therefore, makes the forces 24 to 19.

Jane's Fighting Ships for 1916 gives the British 22 dreadnoughts in commission in August, 1914, including *Erin* and *Agincourt*, and 9 battle cruisers. Not counting the battle cruiser in the Pacific, this gives a total of 30 ships. In addition, *Agamemnon* and *Lord Nelson* were practically dreadnoughts, with their batteries of four 12-inch and ten 9.2-inch guns. Had the British not been willing to fight without their battle cruisers in the Mediterranean and in the dockyards, they could certainly have delayed a decisive action until they rejoined and if necessary until *Agincourt* and *Erin* were commissioned.

Jane gives the Germans 13 dreadnoughts and 5 battle cruisers, of which *Goeben* was in the Mediterranean. The two ships of the *König* class which Mr. Pollen counts as ready were commissioned in October according to the same issue of Jane. Thus the real odds would be nearer 30 to 17 than 24 to 19. In this connection it is interesting to note that Commander Gill gives the figures as 33 to 20, counting in ships which he calls practically completed and including *Goeben*. When you consider that the British had 40 pre-dreadnoughts to Germany's 20—and they were far better ships—34 armored cruisers to 9 and a great superiority of cruisers, destroyers and submarines—the submarine figures being 78 to 30—you will see that the Germans did not have nearly the chances of gaining the command of the sea which Mr. Pollen believes they had.

Mr. Pollen then goes ahead to sketch out what the Germans might have done. First, *Goeben* should have been ordered home. Second, the three Austrian dreadnoughts should have come to Kiel with the pretext of taking part in a review. Third, a surprise night attack should have been made upon the British Fleet before the declaration of war. Fourth, 100 merchant vessels, armed with 4-inch guns, should have been sent to sea as raiders. Fifth, a landing force of 150,000 men should have been landed in England.

This is all very interesting. The reader will have to judge for himself as to whether the British would have been blind and careless enough to have allowed the success of this plan.

CHAPTER IX. THE DESTRUCTION OF "KÖNIGSBURG"

Mr. Pollen quotes a very interesting account of the two attacks of the *Mersey* and *Severn* on *Königsburg*, written by an officer who took part. The first attack was a failure but the second was completely successful. Spotting was done by airplane and proved very efficient. It is interesting to note the gallant action of the observer in the plane, who continued to send out spots after his plane had been hit and was coming down out of control. Mr. Pollen concludes the chapter with the following statement:

"Nothing could better illustrate the curious individualism which governs the organization of our sea forces. Each ship, each squadron, each fleet seems to come to the study of these things as if they were virgin problems, entirely unaided by advice or information from the central authorities, so that there is not only no uniformity of practice—in itself a not unmitigated evil—but what is really serious, a total absence of uniformity of knowledge. I am the last person in the world to suggest that all naval affairs should be regulated in every petty detail from Whitehall. There are quite enough forces at work to repress freedom of thought or restrict liberty to investigate and experiment in the fullest possible way. But there is surely the widest possible difference between a restraining tyranny and an intelligent system of communicating proved principles and the results of successful practice."

CHAPTER X. CAPTURE OF H. I. G. M. S. "EMDEN"

The destruction of *Emden* by *Sidney* is very well described.

CHAPTER XI. THE CAREER OF VON SPEE—CORONEL

Von Spee's strategy is investigated in an interesting way.

In order to clear up some doubt as to the strength of the opposing forces at Coronel, it is interesting to note that the displacement of the British ships was 95 per cent of that of the German ships; their total metal was 67.6 per cent of the German and the metal fired in one broadside was 64.8 per cent. The British had slightly superior speed and their 9.2- and 6-inch guns were 45-caliber against the 40-caliber 8.2- and 5.9-inch guns of the Germans. The German armored cruisers were about 5 years newer than the British, but the *Glasgow* was newer than the German light cruisers. Everything considered, the British strength was probably about 70 per cent of the German. The fact that Craddock fought under adverse light conditions and on such a course that his lower guns could not be used when he had the superior speed is not entitled to consideration. The British made six hits in all, wounding two men. Craddock cannot be blamed, however, for his decision to fight. He had much to gain and many advantages on his side. His heroism will long be remembered by the world.

CHAPTERS XII–XV. BATTLE OF THE FALKLAND ISLANDS

These chapters are among the most interesting in Mr. Pollen's book. There is much original discussion, which is very carefully thought out. It is difficult to agree with a few of his points, but these concern such indefinite questions that it is a matter merely of one opinion against another. While the British did their business in a most thorough manner the most interesting fact of this action, in my opinion, is the splendid gunnery of the Germans. *Scharnhorst* and *Gneisenau* scored 25 hits with 8.2-inch 40-caliber guns against ships which threw 4.1 times their broadsides. *Nurnburg* scored 36 hits on *Kent*, a vessel having over 4 times her weight of broadside. *Leipsic* scored 18 hits on *Cornwall* and caused a loss of 1 killed and 5 wounded on *Glasgow*—the number of hits is not given.

Mr. Pollen discusses at length the important question as to whether a superior force should fight at long or short range. He concludes after a very able analysis that the results will be about the same in both cases, but that the time required in a close action to defeat the enemy will be but one-third to one-fifth of that required if a long range engagement is to be fought.

CHAPTER XVI. THE HELIGOLAND AFFAIR

This action is very capably described. The British, and especially Sir David Beatty, deserve great credit for their splendid work in this affair.

CHAPTERS XVII–XVIII. THE ACTION OFF THE DOGGER BANK

Mr. Pollen's description of this battle is excellent. It was very unfortunate for the British that the flagship of Sir David Beatty was disabled, as this gave the command to an officer who lacked the resolution to continue the pursuit. This failure to push the enemy when great results might have been obtained and the official reports of the Admiralty are severely criticized by Mr. Pollen.

"This being the situation, it seems to me most unfortunate that the Admiralty followed the course they did in communicating their various accounts of this action to us. For there were three accounts given, and no two of the three agreed as to the reason why the pursuit was broken off! For two days we were not told that *Lion* was injured, and for four days were ignorant of the fact that the control of the British Fleet had passed out of Sir David Beatty's hands some time before the action was ended. It was not till March 3—that is, five weeks after the action—that we were told the name of the officer on whom command had devolved when *Lion* fell out of line! This suppression was really extraordinary. To be mentioned in despatches had always been an acknowledged honor. To be ignored was a new form of distinction. How was the public to take so singular an omission? Had it ever happened before that an officer had been in command of a fleet at so grave a crisis and the fact of his being in command suppressed in announcing the fact of the engagement? No one quite

knew how to take it. The discrepancies in the *communiqués* are worth noting. In the first, of January 25, was this curiously worded paragraph:

"'A well-contested running fight ensued. Shortly after one o'clock *Bluecher,* which had previously fallen out of the line, capsized and sank. Admiral Beatty reports that two other German battle cruisers were seriously damaged. They were, however, able to continue their flight, and reach an area where dangers from German submarines and mines prevented further pursuit.'

"Did whoever drafted this statement suppose that the *Bluecher* was a battle cruiser? We are now, however, more concerned with the reasons given for breaking off the action. An area was reached where 'dangers from German submarines and mines prevented further pursuit.' The *communiqué* of January 27 was silent on this point. On the 28th was published what purported to be 'a preliminary telegraphic report received from the vice admiral.' The paragraph dealing with this matter is as follows:

"'Through the damage to *Lion's* feed tank by an unfortunate chance shot, we were undoubtedly deprived of a greater victory. The presence of the enemy's submarines subsequently necessitated the action being broken off.'

"In this statement the excuse of mines is dropped. In the despatch published on March 3 the end of the action is treated by the vice admiral as follows:

"'At 11.20 I called the *Attack* alongside, shifted my flag to her at about 11.35. I proceeded at the utmost speed to rejoin the squadron, and met them at noon retiring north-northwest. I boarded and hoisted my flag in *Princess Royal* at about 12.20, when Captain Brock acquainted me with what had occurred since *Lion* fell out of line, namely, that *Bluecher* had sunk, and that the enemy battle cruisers had continued their course to eastward in a considerably damaged condition.'

"Here observe no mention was made of submarines necessitating the action being broken off, or of an area being reached where dangers from submarines and mines prevented further pursuit. The whole incident is passed by the vice admiral without comment, unless indeed the phrase about the accident to the *Lion,* in the telegraphic report, is a comment. Did the vice admiral imply that had he remained in command he would have seen to it that his specific orders—*viz.,* that *Indomitable* should settle *Bluecher* and the other ships pursue the battle cruisers—were carried out?

"A very unfortunate situation resulted from these reticences and contradictions. Naval writers in America were naturally enough amazed by the statement attributed to Admiral Beatty in the telegraphic report, for, if the presence of submarines could stop pursuit, could not submarines drive the British Fleet off the sea? These authors naturally expressed extreme astonishment that an admiral capable of breaking off action in these conditions, and publicly acknowledging so egregious a blunder, was not at once brought to court martial. No one in his senses could have supposed that Sir David Beatty, who dealt with submarines without the least concern in the affair of Heligoland and earlier in the day, on January 28, could possibly have accepted the dictum that the presence of a German submarine would justify pursuit having been broken off. It was then quite

evident that the quotation from the vice admiral's telegraphic report could not have represented the vice admiral's opinion on a point of warlike doctrine. What the actual facts of the case were, we do not to this day know. Rear Admiral Moore did not continue long in Sir David Beatty's squadron after this, but there was no court martial nor any public expression of the Admiralty's opinion by way of approval or disapproval of his proceedings. In a speech made a month after the action in the House of Commons, Mr. Churchill passed over the fact that the action had not been fought out, as if such a thing was of no exceptional importance or interest whatever. Soon afterward it became known that the rear admiral in question had got another and very important command elsewhere, so that it became plain that his conduct had not met with their lordships' reprobation."

CHAPTERS XIX–XXIV. THE BATTLE OF JUTLAND

Mr. Pollen's account of this battle is the most detailed that has thus far been issued. While some parts of the action are rather hastily passed over, the account is accurate and the comments careful and fair. As regards the deployment of the Grand Fleet, Mr. Pollen's account is apparently much more accurate than the account in the *New York Tribune* of March 9, 1919, which is supposed to be taken from Admiral Jellicoe's book. In this account the sketch shows that at 6.45 there was a distance of 5000 yards between the leading battleship and the rear battle cruiser. This does not coincide with Admiral Beatty's statement that the battle cruisers succeeded in clearing the leading battle squadron only at 6.50. Admiral Beatty also states that at this time the leading battle squadron bore north-northwest, distant three miles from *Lion* (third ship in column). In the sketch of Admiral Jellicoe, at 6.45 the distance was already three and two-third miles and the bearing 305 degrees, a difference of 33 degrees. This point is an extremely important one, as Admiral Jellicoe is apparently trying to show that there was no interference between the battle squadrons and the battle cruisers, which interference is absolutely proved by Admiral Beatty's official report.

Mr. Pollen makes the following comment upon the escape of the German Fleet:

"If the despatch tells us all that was done, one is rather driven to the conclusion that the commander-in-chief assumed that it was not our business, but the Germans' business to resume the action. Why else should he say that 'the enemy made no sign,' or exult in the fact that he knew from his Zeppelin at four o'clock where the British Fleet was if he liked to look for it? Why should the enemy make a sign? Was it not obvious after the events of the preceding day that he could have but one idea and that was safety? Scheer and Von Hipper had certainly done enough for honor. They had inflicted heavier losses than they had suffered. If they could get home they had anything but a discreditable story to tell. If the commander-in-chief really thought it was not his first duty to find and bring the enemy to action again; if the risk of approaching the Jutland coast seemed too great; if the frustration of any ulterior object the enemy might have contemplated the day before seemed cheaply purchased by the

losses the battle-cruiser fleet had suffered, so long as our main strength at sea was not impaired, then the proceedings on June 1, as communicated to us, are perfectly intelligible.

"Yet there must have been many among his officers and under his command who took a diametrically different view. After engaging for the last time at 8.40 on the previous evening, Sir David Beatty says: 'In view of the gathering darkness, and of the fact that our strategical position was such as to make it appear certain that we should locate the enemy at daylight under most favorable circumstances, I did not consider it desirable or proper to close the enemy battle fleet during the dark hours. I therefore concluded that I should be carrying out your wishes by turning to the course of the fleet, reporting to you that I had done so.'

"On the events of June 1, Sir David Beatty's despatch is silent, but it is obvious that it was not his opinion overnight that the morrow should be spent in waiting for the enemy to give a sign, but that, on the contrary, it was certain that he could and should be found and brought to action."

CHAPTER XXV. ZEEBRÜGGE AND OSTEND

The account of these two operations, the most brilliant of the entire war, is admirable.

GENERAL REMARKS

Mr. Pollen has undoubtedly written the best book on the war which has thus far been published. The actions are described in considerable detail. The comments are reasonable and fair. Of course a few may be open to discussion. The exposition of the policy of the British Admiralty is excellent. His excellent articles written throughout the war apparently did much to bring about the great changes in the Admiralty organization. The British Navy at the end of the war was certainly in a most efficient condition, better than it was at any time during the previous four years of fighting. "The British Navy in Battle" is a book which every naval officer can read with profit.

H. H. F.

More members, both regular and associate, are much desired. Any increase in membership invariably means larger number of papers and essays submitted, and consequently an improvement in the PROCEEDINGS.

You are requested to send or give the attached slip to some one eligible for membership, urging him to join.

By direction of the Board of Control,

G. M. RAVENSCROFT,
Secretary-Treasurer.

Attention is invited to extracts from the constitution on the opposite page as to the requirements in making applications for life, regular and associate membership. Members and associate members are liable for the payment of the annual dues until the date of the receipt of their resignation in writing. Annual dues $2.50.

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To the Secretary and Treasurer,
U. S. Naval Institute,
Annapolis, Md.

Dear Sir:

Please enroll my name as a $\left\{\begin{matrix}\textit{regular}\\ \textit{associate}\end{matrix}\right\}$ *member of the U. S. Naval Institute from this date.*

Very truly yours,

....

....

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, \$3.00; enlisted men, U. S. Navy, \$2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

United States to Italy are said to amount to $60,000,000 monthly, while the relief of the Czechs, Jugoslavs, and Serbians costs almost $20,000,000 monthly.

PROPOSED MILITARY AND NAVAL TERMS

At the session of the War Council on March 10 Marshal Foch was generally triumphant in having his conditions accepted. Some important changes were made, however, one of which imposes severer conditions than even Foch proposed.

It was premier Lloyd George who offered this. He asked that the German Army strength should be fixed at 140,000 men. As a result of discussion, it was agreed to fix the army strength at 100,000, or less than half the original maximum recommended under the terms laid down by the Allies.

Germany must raise this force by voluntary enlistment. In order to prevent an army of this size being trained every year, it was provided that the enlistments should be for a period of twelve years. The number of German officers is fixed at 4000, instead of the 6000 as originally contemplated.

All artillery and other equipment in excess of the requirements of the reduced army must be surrendered, and the Imperial General Staff must be abolished.

Other military provisions require the destruction of the Rhine forts and the reduction of the munitions output to the needs of the reduced army.

The naval terms, among other provisions, require the personnel of the German Navy to be restricted to 15,000 men.—*N. Y. Times*, 11/3.

ARGUMENTS AGAINST SINKING GERMAN BATTLESHIPS.—Prior to President Wilson's return to France, a letter said to have been written by him was published in which he expressed tentative disapproval of the proposal to sink the surrendered German battleships. After his return to Paris, however, he again took up the question. The arguments in favor of sinking the ships are summarized as follows by C. H. Grasty (*N. Y. Times*), March 17:

1. In the face of the covenant committal to decreased armament, distribution makes an immediate increase of 30 per cent in allied armaments.

2. As matters stand the American ability to put through a building program creates the possibility of inducing Great Britain to join her in the alternative of scaling down to the lowest point the number of ships consistent with self-protection and maintaining the League, whereas distribution will make new standards to be built up to.

3. Distribution will vastly and unnecesarily increase the burden of taxation.

4. World interests would be subserved by no one power controlling the seas against all comers.

5. The morale of the world requires a dramatic heralding of better days. Distribution is a step in the opposite direction.

6. Destruction preserves entire our moral position with respect to Germany.

7. American interests compel the acceptance of a joint naval burden with Great Britain. Distribution will make that burden too great for America to carry.

8. Finally if the German fleet is thrown among the Allies to be contended for as a prize, it will prove a veritable apple of discord that may make its surrender profit to Germany more than if she had risked her ships in a final battle. The division of naval spoils would be a negation of the principle of co-operation which is the foundation stone of the League.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery. Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U. S. N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U. S. N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U. S. N.

THE COMPOSITION OF THE FLEET. Honorable Mention 1896. By Lieutenant John M. Ellicott, U. S. N.

1897

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U. S. N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U. S. N. I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U. S. N.

Now, therefore, be it resolved, by the Senate of the United States in the discharge of its constitutional duty of advice in regard to treaties, that it is the sense of the Senate that while it is the sincere desire that the nations of the world should unite to promote peace and general disarmament, the constitution of the League of Nations in the form now proposed to the Peace Conference should not be accepted by the United States.

THE PRESIDENT'S NEW YORK SPEECH.—On March 4, on the eve of his return to France, President Wilson spoke at the Metropolitan Opera House in New York. Without entering into a detailed defence of the League Covenant, the President declared that he was amazed at the ignorance regarding the state of the world displayed by its opponents.

"I have heard," he said, "no constructive suggestion, I have heard nothing except 'will it not be dangerous to us to help the world?' It would be fatal to us not to help it." He added that, far from involving us in entangling alliances, the League is "an arrangement which will disentangle all the alliances in the world." The President declared his confidence that the sentiment of the country was behind him.

EX-PRESIDENT TAFT SUPPORTS LEAGUE.—The speech of President Wilson in New York was preceded by an address by ex-President Taft, in which he met in detail the arguments against American support of the League. Mr. Taft declared that our danger from foreign combinations would be greater without the League than with it; that the League covenant contained no provision preventing a country from resisting invasion, such as a border raid from Mexico; that the furnishing of military force to support League decisions would be voluntary rather than compulsory; that the covenant created no super-sovereignty; and that a treaty agreement limiting the power of Congress to make war or to increase armaments was constitutional, as shown by many precedents, such as the agreement with Great Britain not to fortify the Canadian frontier.

Mr. Taft, suggested that there should be some provision in the League plan for withdrawal from the League after reasonable notice. Appropriate words he thought might also be added to show that troubles in any continent would be the primary concern of nations of that continent, or hemisphere. This he considered clearly implied, but its explicit statement would relieve anxiety about European or Asiatic interference in America.

GERMANY

BAVARIAN PREMIER MURDERED.—Kurt Eisner, the Independent Socialist Premier of Bavaria, was shot on the streets of Munich on February 21. The assassin was Count Arco Valley, a Bavarian aristocrat and former officer. The murder was reported to be due to Eisner's exposure of the war guilt of the German military authorities and their inhuman treatment of prisoners of war, made at the Berne Socialist Congress, together with his later statement in Munich that he had documentary evidence to prove that the German general staff continued, even then, to carry on secret dealings with the Russian Reds.

1907

Storekeeping at the Navy Yards. Prize Essay, 1907. By Pay Inspector John A. Mudd, U. S. N.

BATTLE REHEARSALS. A Few Thoughts on Our Next Step in Fleet-Gunnery. First Honorable Mention, 1907. By Lieut. Commander Yates Stirling, U. S. N.

THE NAVAL PROFESSION. Second Honorable Mention, 1907. By Commander Bradley A. Fiske, U. S. N.

1908

A Few Hints to the Study of Naval Tactics. Prize Essay, 1908. By Lieutenant W. S. Pye, U. S. N.

THE MONEY FOR THE NAVY. First Honorable Mention, 1908. By Pay Inspector John A. Mudd, U. S. N.

THE NATION'S DEFENCE—THE OFFENSIVE FLEET. How Shall We Prepare It for Battle? Second Honorable Mention, 1908. By Lieut. Commander Yates Stirling, U. S. N.

1909

Some Ideas about Organization on Board Ship. Prize Essay, 1909. By Lieutenant Ernest J. King, U. S. N.

THE NAVY AND COAST DEFENCE. Honorable Mention, 1909. By Commodore W. H. Beehler, U. S. N.

THE REORGANIZATION OF THE NAVAL ESTABLISHMENT. Honorable Mention, 1909. By Pay Inspector J. A. Mudd, U. S. N.

A PLEA FOR PHYSICAL TRAINING IN THE NAVY. Honorable Mention, 1909. By Commander A. P. Niblack, U. S. N.

1910

The Merchant Marine and the Navy. Prize Essay, 1910. By Naval Constructor T. G. Roberts, U. S. N.

THE NAVAL STRATEGY OF THE RUSSO-JAPANESE WAR. Honorable Mention, 1910. By Lieutenant Lyman A. Cotton, U. S. N.

1911

Navy Yard Economy. Prize Essay, 1911. By Paymaster Charles Conard, U. S. N.

NAVAL POWER. Honorable Mention, 1911. By Captain Bradley A. Fiske, U. S. N.

WANTED—FIRST AID. Honorable Mention, 1911. By Commander C. C. Marsh, U. S. N.

1912

Naval Might. Prize Essay, 1912. By Lieutenant Ridgely Hunt, U. S. N. (retired).

INSPECTION DUTY AT THE NAVY YARDS. Honorable Mention, 1912. By Lieut. Commander T. D. Parker, U. S. N.

1913

The Greatest Need of the Atlantic Fleet. Prize Essay, 1913. By Lieut. Commander Harry E. Yarnell, U. S. N.

NAVY DEPARTMENT ORGANIZATION. A Study of Principles. First Honorable Mention, 1913. By Commander Yates Stirling, Jr., U. S. N.

TRAINED INITIATIVE AND UNITY OF ACTION. Second Honorable Mention, 1913. By Lieut. Commander Dudley W. Knox, U. S. N.

1914

The Great Lesson from Nelson for To-day. Prize Essay, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

NAVAL POLICY AS IT RELATES TO THE SHORE ESTABLISHMENT AND THE MAINTENANCE OF THE FLEET. Honorable Mention, 1914. By Captain John Hood, U. S. N.

OLD PRINCIPLES AND MODERN APPLICATIONS. Honorable Mention, 1914. By Lieut. Commander Dudley W. Knox, U. S. N.

MILITARY PREPAREDNESS. Honorable Mention, 1914. By Naval Constructor Richard D. Gatewood, U. S. N.

1915

The Rôle of Doctrine in Naval Warfare. Prize Essay, 1915. By Lieut. Commander Dudley W. Knox, U. S. N.

AN AIR FLEET: OUR PRESSING NAVAL WANT. First Honorable Mention, 1915. By Lieut. Commander Thomas Drayton Parker, U. S. N.

TACTICS. Second Honorable Mention, 1915. By Ensign H. H. Frost, U. S. N.

DEFENCE AGAINST SURPRISE TORPEDO ATTACK. Third Honorable Mention, 1915. By Ensign R. T. Merrill, 2d, U. S. N.

1916

The Moral Factor in War. Prize Essay, 1916. By Lieutenant (J. G.) H. H. Frost, U. S. N.

NAVAL PERSONNEL. First Honorable Mention, 1916. By Lieut. Commander J. K. Taussig, U. S. N.

EDUCATION AT THE U. S. NAVAL ACADEMY. Second Honorable Mention, 1916. By Lieutenant Ridgely Hunt, U. S. N.

SOME UNDERLYING PRINCIPLES OF MORALE. Third Honorable Mention, 1916. By Commander Dudley W. Knox, U. S. N.

LARGE *vs.* A GREATER NUMBER OF SMALLER BATTLESHIPS. Lippincott Prize Essay. By Lieut. Commander Thomas Lee Johnson, U. S. N.

1917

Commerce Destroying in War. Prize Essay, 1917. By Commander Lyman A. Cotten, U. S. Navy.

THE PEOPLE'S RÔLE IN WAR. First Honorable Mention, 1917. By Lieutenant H. H. Frost, U. S. Navy.

THE NATION'S GREATEST NEED. Second Honorable Mention, 1917. By Colonel Dion Williams, U. S. Marine Corps.

1918

Letters on Naval Tactics. Prize Essay, 1918. By Lieutenant H. H. Frost, U. S. N.

THE PREPAREDNESS OF THE FUTURE. First Honorable mention, 1918. By Commander H. O. Rittenhouse, U. S. N. Retired.

NAVAL STRATEGY. Second Honorable Mention, 1918. By Rear Admiral Bradley A. Fiske, U. S. N.

1919

MILITARY CHARACTER. First Honorable Mention, 1918. By Captain Reginald R. Belknap, U. S. N.

SOME REFLECTIONS ON THE THREE FACTORS OF BATTLESHIP DESIGN. Second Honorable Mention, 1918. By Lieut. Commander Beirne S. Bullard, C. C., U. S. N.

VOL. 45 MAY 1919 No. 195

United States Naval Institute Proceedings

The writers only are responsible for the contents of their respective articles

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Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

COMMUNICATIONS IN THE FAR EAST.

Vol. 45, No. 5 May, 1919 Whole No. 195

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

The writers only are responsible for the contents of their respective articles

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LARGE H-16 TYPE FLYING BOAT.

the doctrine in peace time, prepared and trained the navy to a common understanding of it and supplied it with plans and equipped it with means for their execution. What was needed in October, 1914, was not a new first sea lord, but a higher command charged only with the study of the principles and the direction of fighting." Mr. Churchill was relieved as first lord by Mr. Balfour and Lord Fisher was relieved by Sir Henry Jackson. Again the tide seemed to turn in favor of the British, for the submarine campaign died down in October, 1915, and although revived again in March, 1916, was stopped then by the threat of American intervention. The British supremacy was seemingly definitely proved by the results of the battle of Jutland, which showed to both the British and the Germans that the German High Seas Fleet could never gain the command of the seas.

But the unsatisfactory ending of this battle caused a great controversy. "The critics established themselves in two camps. One side was for facing risks and sinking the enemy at any cost. The other would have it that so long as the British Fleet was unconquered it was invincible, and that the distinction between 'invincible' and 'victorious' could be neglected. After all, as Mr. Churchill told us, while our fleet was crushing the life out of Germany, the German Navy could carry on no corresponding attack on us; and when the other camp denounced this doctrine of tame defense, he retorted that victory was not only unnecessary but that the torpedo had made it impossible.

"Yet, within two months of the battle of Jutland, the submarine campaign had begun again, and, at the time of Mr. Churchill's rejoinder, the world was losing shipping at the rate of three million tons a year. As there had never been the least dispute that to mine the submarine into German harbors was the best, if not the only, antidote, never the least doubt that it was the German Fleet that prevented this operation from being carried out, it seemed strange that an ex-First Lord of the Admiralty should be telling the world, first, that the German Fleet in its home bases delivered no attack on us and therefore need not be defeated! And, secondly, as if to clinch the matter and silence any doubts as to the cogency of his argument, we were to make the best of it because victory was impossible."

The German submarine campaign of the fall of 1916, therefore, brought on the third crisis. "Once more the old wrong remedy was tried. The government and the public had learned nothing from the revelation that we had gone to war on the doctrine that the fleet *need* not, and *ought* not, to fight the enemy, and were apparently unconcerned at discovering that it *could* not fight with success."

While Admiral Jellicoe came to the Admiralty as relief of Sir Henry Jackson the system remained unchanged. The situation grew worse rather than better. "Thus, without having lost a battle at sea—but because we had failed to win one—a complete reverse in the naval situation was brought about. Instead of enjoying the complete command Mr. Churchill has spoken of, we were counting the months before surrender might become inevitable. During the 10 weeks leading up to the culminating losses of April, a final effort was made to make the public and the government realize that failure of the Admiralty to protect the sea-borne commerce of a seagirt people was

due less to the government's reliance on advisers ill-equipped for their task, than that the task itself was beyond human performance, so long as the higher command of the navy was wrongly constituted for its task.

"But when reason and argument had been powerless to prevail, the logic of facts gained the victory. At last, in the fourth crisis of the war, it was realized that changes in personnel at Whitehall were not sufficient, that changes of system were necessary. Before the end of May the machinery of administration was reorganized and a higher command developed, largely on the resisted staff principle."

The principal result of the inauguration of the new system was the establishment of the convoy system which saved the situation as far as the submarines were concerned; but while the system had been changed the persons identified with all the previous failures and who were responsible for the methods and plans that had led to them remained in power. In January, 1918, however, Admiral Wemyss relieved Admiral Jellicoe as first sea lord and Sir Eric Geddes became first lord. From this point on the British naval policy was changed from a passive defensive to a strong offensive. Sir Roger Keyes was appointed to the Dover command and a mine barrage was laid across the Straits of Dover. At the same time another great mine-field was laid across the North Sea from Scotland to the Norwegian coast, and still another was laid in the Kattegat. A very successful raid was made into the Kattegat and Sir Roger Keyes carried out two splendid attacks on the German bases at Zeebrügge and Ostend. The entire situation had been changed and the old supremacy on the sea was definitely assured.

CHAPTER III. SEA FALLACIES

Mr. Pollen defines the ideas regarding the navy and sea power which were held by the British people. Among the many false ideas the two chief ones were the idea at the beginning of the war that battleships were everything, and the later idea that battleships were useless and that submarines were supreme.

"He was wrong then and he is wrong now. It was an error to think of sea power only in terms of battleships. It is a still greater error to suppose that sea-power can exist in any useful form unless based on battleships in overwhelming strength."

CHAPTER IV. SOME ROOT DOCTRINES

There were two schools of thought regarding the navy before the war. One was for the gaining of the decision by fighting. The other idea was to have such a superiority in strength as to gain the victory without having to fight. The later school predominated. According to Mr. Pollen "we showed that our policy was not to attack but to wait attack, and then not to do anything to compel the enemy to attack."

The ideas of the two schools are described by Mr. Pollen as follows: "But in recent history we have witnessed the curious spectacle that an inversion of the order of these two statements did actually create two

different and opposed schools of naval thought. The first school saw in victory the first and constant preoccupation of the fleet. It concerned itself, therefore, chiefly with the essentials to victory, and as victory can only come from fighting it was at the elements of fighting that it worked. It sought to find the most perfect methods of using weapons because it realized that it was only from the evolution of these that right tactics could be deduced. It studied the campaigns of the past to discover the two great groups of doctrines that our fighting ancestors have bequeathed to us, the first dealing with the science of strategy, the second with the principles of command. They realized that weapons and the ships that carry them do not fight themselves but must be fought by men; and they wished those men rightly educated and trained in the subtle and complex science of their high calling. To them, in short, sea war was an affair of knowledge applied by men trained both in the wisdom and in the lofty spirit of those that had excelled in the naval war before. And, faithful to the traditions of the past, no less than eager for research into all the undeveloped potentialities of the products of modern progress, they pinned their faith on their ability to force the enemy to battle, and to beat him there when battle came.

"The other school went for a short cut to naval triumph. If only they could get a fleet of ships so big, so fabulously armed, so numerous as to make it seem to the enemy that his fleet was too feeble to attack, why then battle would be made altogether superfluous, and no further worry over so unlikely a contingency was necessary. They did not, therefore, trouble to inquire either into the processes needed for bringing battle about, or into what was necessary for success when battle came. They passed on to the contemplation of what can only be the fruit of victory—as if victory were not a condition precedent!

"It was, unfortunately, this group, hypnotized by a theory it did not understand, which controlled naval policy in Great Britain for the 10 years preceding the war, and for the first three and a half years of it. Their error lay, of course, in supposing that a fleet, so materially strong and numerous that its defeat was unimaginable because no attack on it could be conceived, must—so long as any serious lowering of its force by attrition was avoided—be the military equivalent to one which had already defeated the enemy; that 'invincible' and 'victorious' were, in short, interchangeable terms. So masterful was this obsession that their apologists—shutting their eyes to the obvious and appalling consequences of this creed in action—two years after the event, still regarded the only encounter between the main fleets in this war as a great victory, because the larger, by avoiding the risk of close contact with the lesser, came out of the conflict with forces as substantially superior to the enemy's as they were before the opportunity of a decisive battle had been offered."

CHAPTER V. ELEMENTS OF SEA FORCE

In this chapter Mr. Pollen describes the policy of the Admiralty in more detail. In 1909 the war staff was instituted but was never given real power.

"But the war staff was never put into the position to discharge the functions which the 1909 committee had designated as its main purpose. So

far from being an authority equipped for the exhaustive study of war and how to prepare for it, the whole apparatus of fighting was carefully excluded from its purview. It had no connection with the departments administering gunnery, torpedoes, submarines, aircraft, or mines. As to some of these activities, there were as a fact no departments solely charged with their control before the war staff was instituted. They were not entrusted to the war staff. And no new staffs were created! If the strategical vagueness, to which the Beresford committee had borne witness in 1909, arose largely, as many supposed, from the uncertain state of naval technique, then, so far as the war staff was concerned, this vagueness had to continue—for technique was not their concern."

After discussing the proper naval strategy for the battle fleet and the submarines, Mr. Pollen says:

"Thus, if there was one form of offensive imperatively imposed on us, it was that of naval artillery; and if there was one form of defensive not less imperatively incumbent, it was the provision of adequate protection against submarines.

"It is now, of course, common knowledge that it was exactly in these two particulars that Admiralty policy from 1904–1914 was either discontinuous, vacillating, and self-contradictory, or simply non-existent. So far as it cultivated anything, it was a defensive tactics for the gun and offensive tactics for the submarine!"

CHAPTER VI. THE ACTIONS

The author now gives a rapid summary of the actions fought during the war and brings out the fact that there was no tactical doctrine in the British Navy. He lays special emphasis upon the strongly contrasted tactics of Beatty and Jellicoe at the battle of Jutland.

"There is no getting out of this dilemma. If Admiral Jellicoe was right in refusing to face the risks inseparable from a resolute effort to make the battle decisive, then Sir David Beatty must have been wrong to have fought in a way which cannot be intelligently explained except on the basis that from first to last he had decisive victory as his object. If the tender care that brought the Grand Fleet through the action with hardly a man killed and only two ships touched was right and wise, then the clear vision, all the more luminous for seeing and counting the cost, which exposed *Indefatigable, Queen Mary,* and *Invincible* to destruction, was woefully wrong. Now it seems extraordinary, if the strategy of waiting to fight till the Germans attacked was right—if this was the Admiralty doctrine—that it was not communicated to Sir David Beatty as well as to Sir John Jellicoe. If it was axiomatic to avoid the risk of ships being destroyed, so that Admiral Moore was right to break off the action at the Dogger Bank and Admiral Jellicoe right in letting the enemy 'open the range under the cover of torpedo attacks,' why was not Admiral Beatty forbidden to jeopardize his ships, and Admiral Arbuthnot warned against any pursuit of the enemy's cruisers or destroyers, that might possibly bring him within range of the German gunfire? How are we to explain Bingham's attack on the head of the German line or Goodenough's recon-

naissance which brought him under the salvoes of the German guns at 12,000 yards? Is the doctrine of caution and ship conservation to apply only to battleships and not to battle cruisers, armored cruisers, light cruisers, and destroyers? Is it only the battle fleet that is not to fight except when it risks practically nothing by doing so? All these questions are forced to the student's attention when he reviews the events here recorded."

CHAPTER VII. NAVAL GUNNERY, WEAPONS AND TECHNIQUE

In this chapter Mr. Pollen gives a clear description of naval gunnery and torpedo fire intended for the civilian reader.

CHAPTER VIII. THE ACTION THAT NEVER WAS FOUGHT

In a comparison of forces at the beginning of the war Mr. Pollen allows the British 20 dreadnoughts and 4 battle cruisers ready for sea—failing to count 3 battle cruisers in the Mediterranean, 1 in a dockyard and 1 in the Pacific. The Germans were allowed 15 dreadnoughts and 4 battle cruisers ready for sea. He, therefore, makes the forces 24 to 19.

Jane's Fighting Ships for 1916 gives the British 22 dreadnoughts in commission in August, 1914, including *Erin* and *Agincourt*, and 9 battle cruisers. Not counting the battle cruiser in the Pacific, this gives a total of 30 ships. In addition, *Agamemnon* and *Lord Nelson* were practically dreadnoughts, with their batteries of four 12-inch and ten 9.2-inch guns. Had the British not been willing to fight without their battle cruisers in the Mediterranean and in the dockyards, they could certainly have delayed a decisive action until they rejoined and if necessary until *Agincourt* and *Erin* were commissioned.

Jane gives the Germans 13 dreadnoughts and 5 battle cruisers, of which *Goeben* was in the Mediterranean. The two ships of the *König* class which Mr. Pollen counts as ready were commissioned in October according to the same issue of Jane. Thus the real odds would be nearer 30 to 17 than 24 to 19. In this connection it is interesting to note that Commander Gill gives the figures as 33 to 20, counting in ships which he calls practically completed and including *Goeben*. When you consider that the British had 40 pre-dreadnoughts to Germany's 20—and they were far better ships—34 armored cruisers to 9 and a great superiority of cruisers, destroyers and submarines—the submarine figures being 78 to 30—you will see that the Germans did not have nearly the chances of gaining the command of the sea which Mr. Pollen believes they had.

Mr. Pollen then goes ahead to sketch out what the Germans might have done. First, *Goeben* should have been ordered home. Second, the three Austrian dreadnoughts should have come to Kiel with the pretext of taking part in a review. Third, a surprise night attack should have been made upon the British Fleet before the declaration of war. Fourth, 100 merchant vessels, armed with 4-inch guns, should have been sent to sea as raiders. Fifth, a landing force of 150,000 men should have been landed in England.

knew how to take it. The discrepancies in the *communiqués* are worth noting. In the first, of January 25, was this curiously worded paragraph:

"'A well-contested running fight ensued. Shortly after one o'clock *Bluecher,* which had previously fallen out of the line, capsized and sank. Admiral Beatty reports that two other German battle cruisers were seriously damaged. They were, however, able to continue their flight, and reach an area where dangers from German submarines and mines prevented further pursuit.'

"Did whoever drafted this statement suppose that the *Bluecher* was a battle cruiser? We are now, however, more concerned with the reasons given for breaking off the action. An area was reached where 'dangers from German submarines and mines prevented further pursuit.' The *communiqué* of January 27 was silent on this point. On the 28th was published what purported to be 'a preliminary telegraphic report received from the vice admiral.' The paragraph dealing with this matter is as follows:

"'Through the damage to *Lion's* feed tank by an unfortunate chance shot, we were undoubtedly deprived of a greater victory. The presence of the enemy's submarines subsequently necessitated the action being broken off.'

"In this statement the excuse of mines is dropped. In the despatch published on March 3 the end of the action is treated by the vice admiral as follows:

"'At 11.20 I called the *Attack* alongside, shifted my flag to her at about 11.35. I proceeded at the utmost speed to rejoin the squadron, and met them at noon retiring north-northwest. I boarded and hoisted my flag in *Princess Royal* at about 12.20, when Captain Brock acquainted me with what had occurred since *Lion* fell out of line, namely, that *Bluecher* had sunk, and that the enemy battle cruisers had continued their course to eastward in a considerably damaged condition.'

"Here observe no mention was made of submarines necessitating the action being broken off, or of an area being reached where dangers from submarines and mines prevented further pursuit. The whole incident is passed by the vice admiral without comment, unless indeed the phrase about the accident to the *Lion,* in the telegraphic report, is a comment. Did the vice admiral imply that had he remained in command he would have seen to it that his specific orders—*viz.,* that *Indomitable* should settle *Bluecher* and the other ships pursue the battle cruisers—were carried out?

"A very unfortunate situation resulted from these reticences and contradictions. Naval writers in America were naturally enough amazed by the statement attributed to Admiral Beatty in the telegraphic report, for, if the presence of submarines could stop pursuit, could not submarines drive the British Fleet off the sea? These authors naturally expressed extreme astonishment that an admiral capable of breaking off action in these conditions, and publicly acknowledging so egregious a blunder, was not at once brought to court martial. No one in his senses could have supposed that Sir David Beatty, who dealt with submarines without the least concern in the affair of Heligoland and earlier in the day, on January 28, could possibly have accepted the dictum that the presence of a German submarine would justify pursuit having been broken off. It was then quite

evident that the quotation from the vice admiral's telegraphic report could not have represented the vice admiral's opinion on a point of warlike doctrine. What the actual facts of the case were, we do not to this day know. Rear Admiral Moore did not continue long in Sir David Beatty's squadron after this, but there was no court martial nor any public expression of the Admiralty's opinion by way of approval or disapproval of his proceedings. In a speech made a month after the action in the House of Commons, Mr. Churchill passed over the fact that the action had not been fought out, as if such a thing was of no exceptional importance or interest whatever. Soon afterward it became known that the rear admiral in question had got another and very important command elsewhere, so that it became plain that his conduct had not met with their lordships' reprobation."

CHAPTERS XIX–XXIV. THE BATTLE OF JUTLAND

Mr. Pollen's account of this battle is the most detailed that has thus far been issued. While some parts of the action are rather hastily passed over, the account is accurate and the comments careful and fair. As regards the deployment of the Grand Fleet, Mr. Pollen's account is apparently much more accurate than the account in the *New York Tribune* of March 9, 1919, which is supposed to be taken from Admiral Jellicoe's book. In this account the sketch shows that at 6.45 there was a distance of 5000 yards between the leading battleship and the rear battle cruiser. This does not coincide with Admiral Beatty's statement that the battle cruisers succeeded in clearing the leading battle squadron only at 6.50. Admiral Beatty also states that at this time the leading battle squadron bore north-northwest, distant three miles from *Lion* (third ship in column). In the sketch of Admiral Jellicoe, at 6.45 the distance was already three and two-third miles and the bearing 305 degrees, a difference of 33 degrees. This point is an extremely important one, as Admiral Jellicoe is apparently trying to show that there was no interference between the battle squadrons and the battle cruisers, which interference is absolutely proved by Admiral Beatty's official report.

Mr. Pollen makes the following comment upon the escape of the German Fleet:

"If the despatch tells us all that was done, one is rather driven to the conclusion that the commander-in-chief assumed that it was not our business, but the Germans' business to resume the action. Why else should he say that 'the enemy made no sign,' or exult in the fact that he knew from his Zeppelin at four o'clock where the British Fleet was if he liked to look for it? Why should the enemy make a sign? Was it not obvious after the events of the preceding day that he could have but one idea and that was safety? Scheer and Von Hipper had certainly done enough for honor. They had inflicted heavier losses than they had suffered. If they could get home they had anything but a discreditable story to tell. If the commander-in-chief really thought it was not his first duty to find and bring the enemy to action again; if the risk of approaching the Jutland coast seemed too great; if the frustration of any ulterior object the enemy might have contemplated the day before seemed cheaply purchased by the

The resulting vessel is, however, still very large and correspondingly costly, and we could not afford to build in great numbers, such as are desirable, seeing that the vessel is needed as a scout and must replace the present scouts as well as the battle cruisers. If the displacement could be cut down to 20,000 tons, the vessel would be much more serviceable as a scout, and, provided the number of guns were not seriously reduced, would still be an ugly customer for a battleship to fight at long range, especially considering the larger number of ships that could be provided at the reduced cost of the smaller units. This smaller size could be somewhat approached by reducing the speed, but this is a doubtful expedient, and the desired result can be better obtained by using a shorter gun.

We have assumed a gun of 50 calibers length, which will not have an angle of fall exceeding 30° except at a range of more than 25,000 yards, if the long-point projectile of standard weight is used. As the number of hits that could be made at such a long range is probably not great enough to produce results, it will be necessary to reduce the range to, say, 18,000 yards. A 12-inch projectile of 2000 foot-seconds initial velocity will have, at 18,000 yards range, an angle of fall of about 30°, and a remaining velocity of about 1200 foot-seconds, which is most likely sufficient to give penetration through a 3- to 4-inch deck. Such conditions can be obtained with a gun of but 35 calibers length, the weight of which would be but half that of the longer weapon. As the weight of the mountings would be correspondingly light, twice the number of guns could be mounted in the same ship, or, what is more to the point, the required number can be mounted in a smaller ship, of the limited size we have been considering as desirable. This is done without sacrificing the speed to any great extent, although to avoid abnormal power in the small ship, the speed should be cut to, say, 32 knots.

The following would then be the general dimensions and chief features of the suggested design:

Length, 650 feet.
Beam, 76 feet.
Draft, 28 feet.
Displacement, 20,000 tons.
Speed, 32 knots.
Power, 100,000 I. H. P.

Battery, sixteen 12-inch 35-caliber guns.
Four 4-gun turrets, with 2-inch sides, 3-inch fronts.
Conning-tower of 3-inch armor.
No other armor, no armored decks.
Ammunition, 300 rounds per gun.
Oil supply, normal, 2000 tons.

There would be no torpedo outfit and no secondary battery. These would appear to be out of place on a vessel of this character. The latter, for use against light craft, is replaced by the light 12-inch battery, and, if desired, there could be supplied for this purpose a thin-walled projectile of about half the standard weight.

Needless to say, a vessel of this kind requires good visibility to develop its full usefulness against capital ships, though it should be within the limits of possibility to develop means of controlling the fire, somewhat in the same way as fire control is practiced ashore. This could probably only be done to a limited extent and under favorable circumstances. Thus, for instance, the battleships being engaged at shorter range, they might have a special fire control party to spot for the cruisers. Many other methods, more or less undeveloped, might be suggested, but of course good visibility makes these vessels independent, which is a great advantage.

A partial range table for the gun described may be interesting:

R	ϕ	ω	V_ω	t
18,000	22° 15′	30°	1195	40
19,000	24 0	32	1195	44
20,000	26 15	35	1200	47
21,000	28 45	38	1205	51
22,000	31 30	41	1215	55
23,000	35 0	44	1230	60
24,000	39 15	48	1260	65

It will be seen that the angle of elevation has great relative intervals, so that errors in pointing will have correspondingly small effect, and so will differences in jump, roll of the ship, and other causes of dispersion. As is well known, at long ranges the dispersion in range decreases, so that, given good fire control, the vessel ought to make good practice at these ranges. At any rate, even if no more than 1 per cent of this is attained, the result, before the allowance is exhausted, would be 48 hits with 12-inch shell, most of them striking on the armored deck of the

enemy, under conditions that would make complete penetration of the deck and explosion within the vital spaces nearly certain.

It is not by any means intended to convey the idea that the cruiser described can take the place of the battleship, or that, if such vessels were built, the battleship would become unnecessary. The latter must always remain as the one vessel which, under any conditions of weather, can successfully stand up and fight any surface vessel of the enemy, provided only that she can come within range. The cruiser described, being an amalgamation of the scout cruiser and battle cruiser types, will do the necessary scouting and screen work of these types, and will finally, on the great day of battle, when all the forces possible must be made available, be ready to take her place in the line and fight the enemy battleships, after having, in all probability, been previously used to bring the enemy to action, by destroying his screen, his auxiliaries, in fact, by delaying the battleships themselves, on account of the tremendous fire they must receive without adequate return fire, until they turn to defend themselves. No success is however possible without the battleships, which alone can sustain action at close range and prevent the enemy from breaking through.

The battleship is the only vessel that can never be caught at a disadvantage, assuming equal numbers, as long as she can get within sufficiently close range. The cruiser, on the other hand, must not be caught at close quarters, and must choose her conditions. These circumstances might be construed into a great handicap for the cruiser, and indeed they are so; but is it not the province of strategy to overcome such difficulties, to choose conditions favorable to oneself, and, if possible at the same time, unfavorable to the enemy?

The numbers of these vessels that might be required would be determined on the basis of their use as scouts, and would be quite large. The use of these vessels against capital ships might even be considered incidental, yet we would have the satisfaction of knowing that, when action is joined, they would not be an encumbrance, they would not need protection, their crews would be fighting men instead of non-combatants, the money invested them would not be an extra outlay for special purposes only. would become actually available in action; in short, we w realize in one more type of vessel the kind of fleet efficien economy desired.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MISSION OF AIRCRAFT WITH THE FLEET

By Lieut. Commander H. T. Bartlett, U. S. Navy

The following is an attempt to point out the importance of aircraft for the navy, and to discuss briefly the duties which they can perform. After some experience, both at home and abroad, I have been struck with the suspicion, and, in some cases, downright antagonism, with which some officers and others in authority among the Allied nations regard all naval aviation.

This has been carried to an extent which has seriously handicapped the flying personnel in carrying out duties outlined below; both because of failure to supply material and personnel, and also a general restriction of all aerial operations.

A great many officers who are far-seeing and progressive believe in the future of aviation, but they have only the haziest ideas as to what aircraft should and can, do.

Aircraft, due mainly to the reliability of the present-day motor and their large cruising radius, have now reached a point where, with skilled personnel, they can carry out all the duties outlined below.

Any fleet which has a number of aircraft squadrons will have a tremendous advantage over one which is not so equipped. We must get carriers in our fleet and aircraft bases at strategical points or we will invite disaster when the next crisis comes.

The following duties, in order of importance, are those which should be performed by naval aircraft:

I. Bombing enemy's men-of-war and bases. Shooting up bridges, tops, balloons, etc., with cannon and machine-guns. Attack with torpedo-planes.

II. Protection of own fleet from hostile aircraft.

III. Scouting.

IV. Reporting on movements of enemy over smoke screens, in low visibility and over the horizon.

V. Detecting mine-fields, torpedoes and submarines.
VI. Spotting.
VII. Escort.

I. BOMBING ENEMY'S MEN-OF-WAR AND BASES

All offensive action must be carried on by heavier-than-air craft until a practical non-inflammable gas is in use for lighter-than-air craft. At present, dirigibles are easy targets, as one in-

U. S. N. "H-16" BOAT, SHOWING "ALL AROUND" ARC OF FIRE WITH FOUR SEPARATE GUN MOUNTS. ONE, TWO OR THREE GUNS CAN BE MOUNTED ON EACH.

cendiary bullet will set them in flames. They must keep away from hostile aircraft.

Offensive action against surface craft was not of much use in the war, but will become increasingly important, and, it is believed, to an extent that will revolutionize the construction of men-of-war. The reasons for the limited number of successful air attacks on vessels were: Lack of opportunity, small size of bombs, poor bomb sights, untrained bombers, insufficient number of planes and material, and a poor development of aerial strategy and tactics.

Vol. 45, No. 5 May, 1919 Whole No. 195

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

do not take the place of carriers. Bases have the same fault as fixed coast defences—the enemy will always "come where they ain't." Carriers are like railroad artillery, they can always meet the enemy no matter where the attack comes from, and, in addition, can accompany the fleet and attack as well.

If hostile aircraft are to be encountered, the large bombers, seaplanes and torpedo-planes *must* be, and the two-seaters *should* be, convoyed by fighters for day work.

All "day bombing" should be formation work, and should be concentrated.

With the present inaccuracy of anti-aircraft fire from ships, bombers could go over as low as 4000 feet in the daytime. At night, both bombing and torpedo work are much easier, as surface craft can generally be seen in any but the darkest nights, whereas aircraft are invisible and could go over as low as 2000 feet.

Bombs must be suited to their objectives just as projectiles are. Against capital ships and concrete, the largest possible bombs should be used. As already stated 1650-pound bombs were used in the war, and 3300-pounders were being experimented with when the armistice was signed. Against light cruisers, destroyers and bases not under concrete, a number of smaller bombs would be more effective; the 230 and 520 were mostly used. Against personnel, a large number of small bombs with good fragmentation, such as the 20-pound Cooper, are the best.

For action against surface craft and land objectives, heavy case bombs should be used, as the destructive effect of the fragments is important; whereas against submarines, light case with a correspondingly larger amount of explosive should be used, as the force of the explosion is the only consideration. For both submarine and surface craft bombing, a delayed action fuse is necessary; in the one case to get under water, and in the other (coupled with a heavy armor-piercing nose) to get through the upper decks.

With the accuracy of our new sights and the application of proper tactics and material, the importance of the future of bombing cannot be overestimated.

Gunnery work from aircraft against any enemy except aircraft is secondary to bombing, but undoubtedly much da

could be done by both single-seater and two-seater fighters against bridges, tops, etc., with machine-gun and cannon. The $1\frac{1}{2}$-inch automatic cannon now in use and the 3-inch semi-automatic now being constructed, will greatly increase an aircraft's offensive powers.

U. S. N. COASTAL DIRIGIBLE SHIFTING CREW WITHOUT LANDING.

There is undoubtedly an important use for torpedo-planes, especially for night work. It is understood that in recent maneuvers six British torpedo-planes attacked destroyers at 25 knots and made four direct hits.

II. PROTECTION OF OWN FLEET FROM HOSTILE AIRCRAFT

As the offensive use of aircraft outlined in I is increased, there must be a corresponding increase in defence. There is no doubt that the primary defence against hostile aircraft is fighting air-

craft of your own. These give a much greater protection than is possible with anti-aircraft fire, which for many reasons is not nearly as efficient from ships as ashore. Fighting aircraft not only protect vessels from direct attacks, but if in sufficient numbers and properly handled, should prevent the enemy's planes from carrying out any of their duties, such as scouting, escort, spotting, etc.

There was no general aircraft fight at sea during the war, for the reason that the British did not realize the value of planes with the fleet until after Jutland, and never had another chance. The Germans did not develop seagoing aircraft sufficiently to attack, and the Zeppelins were too vulnerable. Both sides were getting ready for a very large aircraft offensive in connection with their fleets towards the end of the war. The British had a number of aircraft carriers with a large number of planes, converting some of their largest ships for this use. In addition, they had planes on all battle and light cruisers, and were putting them on some of their dreadnoughts. In October, when they thought the enemy's fleet was coming out, they were concentrating all available planes at their North Sea bases. The Grand Fleet was to be accompanied by an overwhelming number of aircraft (many hundred), both for protection against Zeppelins and large bombers, to attack the enemy, and for the other valuable duties of scouting, spotting, etc., which could best be performed by aircraft.

This engagement was only prevented by the mutiny in the German Fleet when it was ordered out in October, 1918.

Efficient fighting aircraft are at present single- and two-seater, light fast planes, but undoubtedly in the future there will be a large flying boat which will be armored around the vital parts, and will carry cannon as well as machine-guns. French flying boats are already carrying 3-inch guns. This craft will have no "blind spots," and will be able to put out such a volume of fire that no small fighter can get in on her.

Lighter-than-air craft should make formidable fighters, c to their stability and the heavy armament they can carry. only after a non-inflammable gas is adopted.

Aircraft in contact with the enemy must keep alway proper formation. This is the secret of successful aeria ing and bombardment.

III. SCOUTING

For scouting and long distance reconnoissance aircraft are far ahead of surface craft because of their great speed. We now have seaplanes with a radius of 1200 miles. It is easy to see the efficient work a squadron of such planes could do with their speed of 60 miles per hour, coupled with efficient radio work. Dirigibles are also valuable in scouting, but at present are more liable to be weather bound than seaplanes, as the latter can now go out in nearly any weather.

M. S. "FURIOUS," USED AS AN AIRCRAFT CARRIER. 32-KNOT BATTLE CRUISER WITH TURRETS TAKEN OFF.

For scouting near the fleet, say up to 150 or 200 miles, the two-seater bombing and fighting planes could also be used, operating from the carriers.

Many valuable reports as to the movements of the enemy were made both from lighter- and from heavier-than-air craft.

Scouting altitude and distance (distance between planes) depends upon the visibility and the type of craft that it is expected to meet. It ranges from 1000 feet altitude and a few thousand yards apart for submarine search, to several thousand feet altitude and a 50-mile or more distance for surface craft. In clear weather, high altitudes and greater distances give the most efficient results. Often it is necessary to come down very low to get under the clouds or low visibility. Often it is possible to go

over or around a rain-squall or mist, and still have good visibility. If fog is encountered, it should always be run away from, or if in a proper place, a landing made before it closes in. On any patrol, if fog or heavy clouds are encountered, different altitudes, determined beforehand and at least 500 feet apart, should always be taken at once to avoid collision.

IV. REPORTING ON MOVEMENTS OF ENEMY OVER SMOKE SCREENS, IN LOW VISIBILITY AND OVER THE HORIZON

Reporting enemy's movements overlaps scouting, but reports when in contact or almost in contact with the enemy can be made by nearly any type of aircraft including heavier-than-air craft, dirigibles and balloons. The great value of aircraft for this work was proved in many maneuvers in the Grand Fleet. Many times when the fleet was absolutely blinded, due to smoke, poor visibility or distance, all the information desired by the admiral was sent down from the air. Types of ships, formations, base courses, changes in base courses, etc., are easily seen. Radio telephones should always be used for all communication work up to their distance limit, and then radio telegraph. Visual signals are only secondary in case of radio failure.

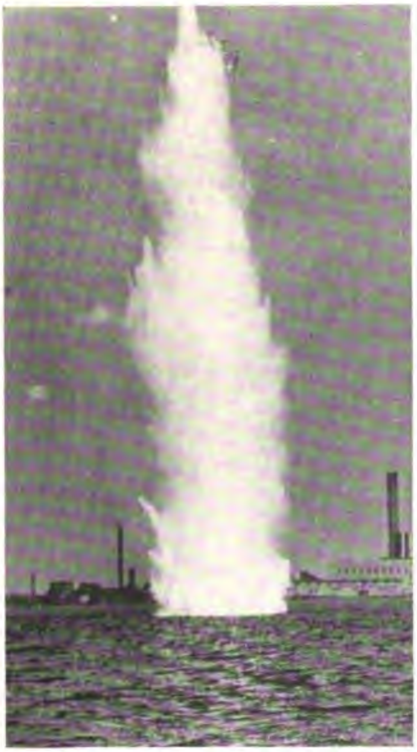
V. DETECTING MINE-FIELDS, TORPEDOES AND SUBMARINES

In detecting mine-fields and submarines from aircraft, two factors must be considered: the clearness of the water and the condition of the atmosphere. Ability to see under water varies with these two factors. Under the most favorable conditions, such as can be found in the Caribbean, very clear water and a strong sun overhead, it is possible to make out a shape over 100 feet under water. In muddy water, such as the Chesapeake in the spring, nothing can be seen a foot under the surface, and under-water visibility varies between these two conditions.

In general, in blue water, mines can be picked up some fathoms under, especially if there is a bright sun behind, and subma to a greater depth. Of course, submarines light or awa easily seen and the V wake from a periscope is visible distance in moderately smooth water.

The wake of a torpedo is easily picked up, and if the is connected with the ship control by telephone, direc avoiding it are of great assistance.

For detecting submarines, mines and torpedoes, dirigibles and balloons are probably more efficient than heavier-than-air craft, owing to their ability to stay in one place, and their greater ease of observation. A great deal of this work was done in the war by all three types of aircraft. Mine-fields and floating mines were reported frequently, and many submarines discovered and attacked, or reported to surface craft.



DETONATION OF AIRCRAFT DEPTH BOMB.

VI. SCOUTING

It is thought that two new factors when properly developed will mean a great deal to gunnery in the fleet. These are the use of star shells at night and aircraft spotting by day. The former was developed by the enemy on the Belgian coast. Star shells as large as 8 inches were used both against aircraft and men-of-war. The latter was brought to a high state of efficiency for

land work on the Western front, practically all efficient long-range shooting being controlled by aircraft.

The Grand Fleet was using aerial spotting for long-range work and an efficiency of at least 300 per cent higher was obtained from aerial spots than from ship spots. Our latest 14-inch 50-caliber gun can shoot over 28,000 yards, and undoubtedly will open fire at at least 25,000 yards in the future. It is not believed that ship spotting can be accurate at over 18,000 yards, whereas aircraft spotting is efficient for any distance and is not affected by smoke screens.

112-, 230- AND 520-POUND BOMBS.

Kite balloons have the great advantage of direct telephone communication, but the disadvantage of giving away your position to the enemy. They also have a bad whip when a salvo is fired, and cannot be used in bad weather.

Dirigibles seem the best aircraft for this work, using radio telephone, but they also are liable to be weather bound.

Heavier-than-air craft are handicapped by the difficulty of keeping the plane in a position such that the observer can always see the target. Planes having the best visibility (flying boat with a front cockpit) should be used and radio telephone for

communication. This should be connected with plot, and the gunnery officer connected in with one earpiece.

The altitude depends on conditions of visibility. In general, from 1000 to 5000 feet.

U. S. N. "H-16," SHOWING THE TOP AND ONE SIDE TAIL GUNS.

The procedure would be as follows for front cockpit boats:

(a) Planes leave the carrier (or report from base) 15 minutes before opening fire, and get the altitude that will give them the best visibility; in clear weather, about 3000 feet.

(b) Test out radio phones. Must be able to talk clearly with plot. Test out radio telegraph and other secondary signal systems in case the phone fails. Signals that have been used with varying success are different colored smoke puffs, maneuvering the plane, and flags and streamers.

(c) Notify plane to stand by three minutes before first salvo. Plane will then maneuver so as to pass over firing ship in line of fire, flying towards the target, at the instant first salvo is fired.

(d) Notify plane which target ship is firing at, and keep him informed if aim is shifted.

(e) Notify plane of approximate range.

(f) At instant of firing sing out "fire" to spotter so that he does not have to strain his eyes watching for the blast or splash.

(g) Plane should pass over firing ship as first salvo goes and spot for first salvo in this line of flight. Spotter always uses standard terms, as "up 100, right 02," or "down 100, left 3." Spotting must be quick and accurate, and when using radio phones should be in as soon as the ship spotter's corrections. Only *trained* spotters should operate. A good spotter with some air experience should increase spotting accuracy several hundred per cent, whereas the best aviator in the world, if not an expert spotter, would be sure to make a mess of things.

(h) After first spot is out, turn to right or left, and fly back and forth in front of the firing ship, always turning towards the target. In order that each turn does not increase the distance from the firing ship, and so decrease the strength of the phone and get into the trajectory, each leg must incline towards the firing ship. As each "fire" comes over the phone the pilot can kick the nose toward the target and then back again after the spot is out. This prevents the wing from obscuring the observer, and by maneuvering in this manner every salvo should be spotted. Care must be taken not to get too far from the firing ship, or the plane, unless very high, will get into a dangerous part of the trajectory. For a 14-inch 50-caliber, at 20,000 yards, the maximum ordinate is 4600 feet, and for 25,000 yards is 7300 1 rough rule, good up to an ordinate of about 2000 feet, the range is equal to the ordinate times the cotangent angle of elevation. For instance, for a 20,000-yard t then

$$
\begin{aligned}
X &= 1000 \cot 12^\circ\ 57'.5 \\
&= 1000 \log 10.63803 \\
&= 1445 \text{ yards.}
\end{aligned}
$$

From this it can be seen that if a plane flew 1445 yards in front of the firing ship at 1000 feet, she would get into the trajectory of the projectile. The data for this formula can be obtained for any gun from the range tables, and will always keep the plane above the projectile, as it is accurate for the straight path and thereafter the curve is down, or away from the aircraft. A safety allowance should be added to this to provide for high shots and air disturbance.

VII. Escorts

Escorting surface craft and submarines has been one of the most important duties performed by aircraft. There were almost no cases of submarines attacking a convoy when there were aircraft present, as the German commanders always submerged when a plane was seen or heard. The Dutch and Channel convoys, and, towards the end, the French coastal convoys, were nearly always escorted by planes as well as surface craft.

Dirigibles are more suitable for convoying than planes, owing to the greater ease with which they can remain over the convoy. This obtains always, provided no contact is made with the enemy's aircraft, when dirigibles would probably be shot down.

Pilots must remember that the mission of escort craft is to get the convoy to its objective, and must not leave their station for any reason except motor failure. There is no excuse for chasing an enemy sighted on the horizon, and then have a hostile submarine come up and get several ships.

The tactics of escorting convoys, scouting, searching for mines and submarines, etc., were brought to a high state of perfection under Commander Kenneth Whiting, U. S. Navy, at our North Sea Air Station at Killingholme. The deep sea (submarine and mine search) and the convoy squadrons were always in the air; the latter escorting convoys having as many as 150 ships. About 6200 ships were convoyed by our planes from this one station, in the less than four months of our régime, with only one ship sunk, and this when the escort planes were down with motor trouble. This was done in the most active submarine zone, the East Coast of England. Letters from the Admiralty and the Vice Admiral commanding that part of the coast, testify to the British Navy's high opinion of the importance of this work.

Admiral Fiske's Idea Being Put Into Effect.

Long range, therefore, offers the only means by which the lightly armored battle cruiser can hope, in action, to give as much as she must take. It will then be in order to investigate the prospects such a vessel would have in such an engagement.

Although assuming equal skill on both sides, long range firing really requires less skill, except in spotting, than in the case of short ranges. This is because the error in range due to a given error in elevation is much less at longer ranges, so much so that at extreme ranges, with high elevations, there might be several degrees error in elevation with no great error in range. It all comes down to a matter of skill in spotting and keeping the range. With equal skill, hitting at long range is entirely a question of chances, and is practically in accordance with the law of probability.

This being so, the question is at once seen to be one of the number of shots that can be fired on either side, in equal times. This also, since equal rates of fire per gun must be assumed, is reduced at once to the simple matter of the number of guns on the two sides, so that, where the battle cruiser has eight guns to the battleship's 12, it is readily seen that it will require at least three of the former to be on even terms with two of the latter, neglecting any superiority in fire control that is inherent in the superior fire concentration of the two battleships. Since battle cruisers cost twice as much as battleships, and require the same numbers of men per ship, it can hardly be said that building battle cruisers to fight battleships is an economical proposition.

Since the battle cruiser must fight a capital ship at long range, and since, at such ranges, vertical armor becomes so small a target as to have a very small chance of being hit, the idea seems to suggest itself to save money and displacement by omitting such side and other vertical armor, and indeed this seems quite logical. In action with a battleship at any range, it would seem that such armor as can be carried would probably be penetrated if hit, and the only reason that might be assigned for carrying it at all is to prevent damage from the lighter guns of small craft, if the vessel were unexpectedly to find herself in close contact with such small craft.

This could not be called a logical reason, as the weight of armor to be carried would be a severe penalty to pay for the chance of accidentally or carelessly running into such an en-

counter. In any case, if the turrets and conning-tower were lightly armored, there could hardly be much damage done in the few minutes necessary for the larger vessel to wake up, and careful hull design could keep it at a minimum. Besides, the same reasoning that requires the armor would make necessary elaborate underwater protection against torpedoes, since there is a pretty fair chance of being in range of a torpedo vessel. This is not done, cannot be done, for obvious reasons, and is very frankly left to chance. It seems clear that most of the armor should be omitted.

The same reasoning that requires the omission of the armor will also indicate the uselessness of armored decks. The vessel cannot fight at short range, at which only the armored deck would be of value. At long range any deck that could be fitted would be penetrated. It seems clear that the heavy weight of decks that are fitted for protective purposes only should be saved.

These two changes would at once make an enormous reduction in the displacement and cost of the vessel, other things being equal. It would appear feasible to reduce the displacement 7000 to 8000 tons without affecting the other characteristics, or to, say, 27,000 or 28,000 tons. Even this might be a high figure, since considerable power will also be saved, for the same speed.

Omitting the protection will reduce the cost of the vessel so much that more ships can be placed in the line to fight against capital ships. This consideration in itself will reduce the handicap under which the vessels must work, although the battery power of the individual vessel is not increased.

The vessels now carry a heavy weight of battery, although the number of guns is small. Consideration of the law of probability, as has been indicated above, shows that the vessels should instead carry a large number of guns, if they are to fight battleships on equal terms. It is clear that they cannot carry a larger number of the same heavy guns without again increasing size and cost. There is then no course open, if the number of guns is to be increased, except to use a smaller and lighter gun. It is then necessary to decide as to the proper caliber and weight of gun such a vessel should carry.

As the greatest possible number of guns is to be mounted, the smallest and lightest gun possible must be adopted. This will be the smallest gun that can be relied upon, at the fighting

effect on the latter that the wings collapsed and the pilot was hurled to sudden death. In another case when the torpedo had been discharged, it hit the water at an awkward angle, and ricochetting over the surface, rose and demolished the aeroplane which had not risen out of the way. This discharging of a torpedo was no light risk when the torpedo was of full size, weighing anything up to a ton—three times the weight of the machine in which Blériot first crossed the English Channel.

A good deal of practice and patience was needed to make torpedo attacks from aeroplanes a success, and it is a tribute to the indomitable perseverance of our naval pilots that they have at length developed some formidable squadrons with special efficiency in this new work. These wonderful aeroplanes can go up from land or from the deck of a ship, and can descend on the sea and float until help is brought by wireless. When the German Fleet surrendered, an aeroplane "mothership" with 20 of these machines in its bosom met the Huns 50 miles out at sea, and had any tricks been tried it would have been simple work for a score of mystery aeroplanes to have leapt into the air and torpedoed the best part of the ships. This mystery or "Cuckoo" aeroplane—so called because of its weakness for laying eggs in other people's nests—is one further testimony to British engineering ability and resourcefulness of our navy.

REAR ADMIRAL FISKE INVENTED THE TORPEDOPLANE

Rear Admiral Bradley A. Fiske, U. S. N., conceived the idea of a torpedo-carrying aeroplane in the winter of 1910-1911 as a means of defending the Philippine Islands, and discussed the idea with the General Board of the navy. He was in charge of the "War Plan Section" of the General Board, U. S. Navy, and in that capacity suggested that the Philippines could be defended against invasion by means of a large number of aeroplanes which would drop bombs on enemy boats going ashore from the transports and on men who might be landed, and that by using aeroplanes of a larger size it would be possible to drop torpedoes from them which would sink the men-of-war and the vessels of the invading fleet.

In April, 1912, Rear Admiral Fiske applied for patent on the torpedoplane, which was granted in July, 1912, by the U. S. Patent Office.

THE ITALIAN EXPERIMENTS OF 1912

The Italians were the first to make experiments in dropping weights from an aeroplane, with a view of evolving a method of launching torpedoes. Captain Alessandro Guidoni, Royal Italian Navy, using a 1910 Farman biplane equipped with floats, made a number of experiments at an Italian naval base in 1912-1915.

The resulting vessel is, however, still very large and correspondingly costly, and we could not afford to build in great numbers, such as are desirable, seeing that the vessel is needed as a scout and must replace the present scouts as well as the battle cruisers. If the displacement could be cut down to 20,000 tons. the vessel would be much more serviceable as a scout, and, provided the number of guns were not seriously reduced, would still be an ugly customer for a battleship to fight at long range, especially considering the larger number of ships that could be provided at the reduced cost of the smaller units. This smaller size could be somewhat approached by reducing the speed, but this is a doubtful expedient, and the desired result can be better obtained by using a shorter gun.

We have assumed a gun of 50 calibers length, which will not have an angle of fall exceeding 30° except at a range of more than 25,000 yards, if the long-point projectile of standard weight is used. As the number of hits that could be made at such a long range is probably not great enough to produce results, it will be necessary to reduce the range to, say, 18,000 yards. A 12-inch projectile of 2000 foot-seconds initial velocity will have, at 18,000 yards range, an angle of fall of about 30°, and a remaining velocity of about 1200 foot-seconds, which is most likely sufficient to give penetration through a 3- to 4-inch deck. Such conditions can be obtained with a gun of but 35 calibers length, the weight of which would be but half that of the longer weapon. As the weight of the mountings would be correspondingly light, twice the number of guns could be mounted in the same ship, or, what is more to the point, the required number can be mounted in a smaller ship, of the limited size we have been considering as desirable. This is done without sacrificing the speed to any great extent, although to avoid abnormal power in the small ship, the speed should be cut to, say, 32 knots.

The following would then be the general dimensions and chief features of the suggested design:

Length, 650 feet.
Beam, 76 feet.
Draft, 28 feet.
Displacement, 20,000 tons.
Speed, 32 knots.
Power, 100,000 I. H. P.

torpedoplanes were made heartsick by the report that the British steamship *Gena* had been torpedoed by a German torpedoplane.

The torpedoing of the *Gena* by a German seaplane was reported by the British Admiralty on May 2, 1917. The report read as follows:

The British steamship *Gena* was sunk yesterday (Tuesday) by a torpedo discharged from a German seaplane off Aldeburgh. All hands were saved. Another seaplane concerned in this attack was brought down by gunfire from steamship *Gena* and the crew were made prisoners. The following is the German version of the incident, sent out from Berlin on May 2:

"Yesterday morning a number of our seaplanes attacked some enemy merchant ships off the Thames and sank a large steamer of about 3000 tons. One of our machines has not returned, and it is supposed that it is lost."

In connection with the above, it is stated by the Admiralty that this method of attack was first practiced successfully in August, 1915, by R. N. A. S. pilots, who sank several ships in the Dardanelles by torpedo from seaplanes.

A sketch of one of the German seaplanes that participated in the attack against the *Gena,* showing the pontoon arrangement for holding the torpedo, which was published in a British magazine, shows that the arrangement for holding the torpedo in the German seaplane is exactly like the arrangement on Admiral Fiske's torpedoplane. The torpedo is held between the two pontoons of the seaplane with a bracing to keep the torpedo from moving while the seaplane is flying.

It seems that the Germans continued their experiments and had torpedoplanes at Ostend and Zeebrugge. But they used single motored seaplanes, the speed of which was cut down considerably by the weight of the torpedo. According to reports, on one occasion the German torpedoplanes tried an attack from Zeebrugge on some British destroyers that were shelling Zeebrugge. The report states that the British did not expect to be able to spot the attacking torpedoplanes, but they knew that the Germans had set their torpedoes to be dropped from a given height, not above 20 feet, and the attack would be made from a given direction, and the aviators had had little practice. The British destroyers set up a water barrage across the way from which the German torpedoplanes were to come by firing on the water. This is said to have created an effective water barrage which made the German pilots resolve to turn back.

enemy, under conditions that would make complete penetration of the deck and explosion within the vital spaces nearly certain.

It is not by any means intended to convey the idea that the cruiser described can take the place of the battleship, or that, if such vessels were built, the battleship would become unnecessary. The latter must always remain as the one vessel which, under any conditions of weather, can successfully stand up and fight any surface vessel of the enemy, provided only that she can come within range. The cruiser described, being an amalgamation of the scout cruiser and battle cruiser types, will do the necessary scouting and screen work of these types, and will finally, on the great day of battle, when all the forces possible must be made available, be ready to take her place in the line and fight the enemy battleships, after having, in all probability, been previously used to bring the enemy to action, by destroying his screen, his auxiliaries, in fact, by delaying the battleships themselves, on account of the tremendous fire they must receive without adequate return fire, until they turn to defend themselves. No success is however possible without the battleships, which alone can sustain action at close range and prevent the enemy from breaking through.

The battleship is the only vessel that can never be caught at a disadvantage, assuming equal numbers, as long as she can get within sufficiently close range. The cruiser, on the other hand, must not be caught at close quarters, and must choose her conditions. These circumstances might be construed into a great handicap for the cruiser, and indeed they are so; but is it not the province of strategy to overcome such difficulties, to choose conditions favorable to oneself, and, if possible at the same time, unfavorable to the enemy?

The numbers of these vessels that might be required would be determined on the basis of their use as scouts, and would be quite large. The use of these vessels against capital ships might even be considered incidental, yet we would have the satisfaction of knowing that, when action is joined, they would not be an encumbrance, they would not need protection, their crews would be fighting men instead of non-combatants, the money invested in them would not be an extra outlay for special purposes only, but would become actually available in action; in short, we would realize in one more type of vessel the kind of fleet efficiency and economy desired.

The committee had the choice between concentrating its efforts in developing large seaplanes and training aviators to drop full-sized Whitehead torpedoes, which weigh 2000 pounds and measure 21 inches in diameter and 17½ feet in length, or to develop a torpedo small enough to be carried by any of the two-passenger flying boats or hydroaeroplanes now in general use. The committee came to the conclusion that, owing to the fact that there were very few aviators in the United States who had any experience in piloting a large seaplane and owing to the time that would be required to train men to drop such heavy weights from an aeroplane, it would be best to concentrate efforts in developing a small torpedo, weighing less than 200 pounds, which could be dropped from the average two-passenger seaplane by almost any aviator. This would make it possible in time of war to press into service for launching of torpedoes almost every civilian, naval, and military aviator who had sufficient experience to pilot a machine.

At first it seemed impossible to develop an automobile torpedo weighing less than 200 pounds, having a range of about 1000 yards at a speed of about 25 knots, but the committee was willing to have experiments carried out regardless of the possibility of failure, and three leading experts on torpedoes promptly took up the work and soon advised the committee that such a torpedo could and would be developed. Before the small torpedo had been perfected, however, large aeroplanes had come into use, and the need for small torpedoes ceased.

CHECKING THE VELOCITY OF FALL BY MEANS OF AUTOMATIC BRAKES

Some years ago I had occasion to discuss, first with Admiral Fiske and then with Allied officers, the advisability of using automatic brakes to check the velocity of fall of the torpedo. This discussion led to considering a number of methods, such as lowering the torpedo by means of a cable. But it was realized that while it would be feasible to lower the torpedo several hundred feet by means of a cable, and its direction could be maintained by means of vanes, and the possible swerving of the torpedo might also be checked by means of vanes, which would hold the torpedo steady excepting in case of sudden turns, the advantage to be gained was not apparent.

Experiments in this direction should, however, be conducted to ascertain just what can be done.

HOW THE TORPEDOPLANE CAME NEAR BEING ABANDONED

The torpedoplane has had an eventful career. It suffered through scant attention and long drawn superficial experiments without suitable aeroplanes, suitable torpedoes, and proper appreciation of its potentiality.

Naval operations must, of course, be carried out with thoroughly tested weapons and the torpedoplane could not be considered as an available weapon until it had been reported favorably by the ordnance experimental "shops." Unfortunately, the ordnance experimental shops of the Allied countries were not equipped with aeroplanes with which to conduct tests, and air stations did not have torpedoes; and somehow, any proposition to send torpedoes to air stations or send aviators to ordnance testing stations was always sidetracked in transit.

Oftentime the experiments were sidetracked because it was held that the enemy's ships were not operating on the high seas and the only way to reach them was to attack them in their bases. This was held to be impossible because these bases were located within defences, and it was held that torpedoplanes would not succeed in penetrating the enemy's defences. Hence it was deemed impracticable to attempt torpedoplane operations. The advent of the British Air Ministry in 1918, which resulted in placing Captain M. F. Sueter in an important executive position, resulted in the continuation of the experiments on an extensive scale. The torpedoplane "graduated" from the ordnance experimental "shop" and was immediately recognized as a potential weapon, and plans were made to use it extensively against the German Navy, attacking the German ships in their bases.

FACTORS THAT GOVERN SUCCESS OF TORPEDOPLANE OPERATIONS

The main factors that govern the success of torpedoplane operations are:

(1) The use of fast, camouflaged aeroplanes, equipped with mufflers, so that the approach cannot be seen or heard by the enemy until the torpedoplane has arrived within striking distance.

(2) Having an experienced crew, well trained and experienced in the work.

(3) Having torpedoes powerful enough to be effective against the ships to be attacked.

(4) Dropping the torpedo from a suitable height to prevent its being put out of order by a too great impact or of its rebounding and striking the tail of the torpedoplane.

(5) Holding the torpedo in position and dropping it while the torpedoplane is flying towards the ship so that the gyroscope, being started while the torpedoplane is heading for the ship, will direct the torpedo in the direction of the ship. The plane may, of course, change its direction immediately after dropping the torpedo and make its escape.

FUTURE TORPEDOPLANES

The naval seaplane *N C-1*, could easily carry two full-size torpedoes. This flying boat has a wing spread of 126 feet and is equipped with three low-compression Liberty motors of 350 H. P. each. It has a cruising speed of 80 miles an hour, weighs 13,000 pounds unloaded and 22,000 pounds fully loaded.

The British flying boat constructed by Colonel Porte of the Royal Air Force is larger. It is a triplane, equipped with five Rolls Royce motors.

Larger seaplanes are under construction and it is expected that aeroplanes capable of lifting 25 tons will be produced this year and over double that size next year. Larger still will follow.

ONE HUNDRED MILES AN HOUR TORPEDO BOATS!

Some of the transatlantic flyers being planned are to be capable of covering 3000 miles without stopping.

These machines can be converted into torpedoplanes by merely attaching the torpedoes under their planes or at some other convenient place.

And then they become flying torpedo-boats, capable of cruising at a speed of about 100 miles an hour and of crossing the Atlantic within 30 hours!

A crew of half a dozen men will be sufficient to operate such a torpedoplane.

What a marvellous combination of speed, potentiality and mobility!

What better weapon can we find for the defence of our coasts and island possessions?

An enemy fleet bent on attack or carrying an invading force would have to contend with large torpedoplanes before it could come within 1000 miles of our shores and with smaller torpedoplanes launched from aerodrome ships, such as are recommended by Admiral Rodman.

Our island possessions will be most powerful as torpedoplane *bases,* almost invulnerable.

Is this not truly revolutionary in its prospective developed stage?

110-Foot Submarine Chaser.

Eagle Class Patrol Boat.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE 110-FOOT SUBMARINE CHASERS AND EAGLE BOATS

By Commander J. A. Furer, Construction Corps, U. S. Navy

The usefulness of naval craft at the lower end of the scale of size and power has been one of the striking lessons of the war. For many years the thought of the naval designer had been directed only toward the production of larger and more powerful types of vessels, whether submarines, destroyers or capital ships. The idea that any surface fighting craft smaller in size than a destroyer could have a place in a well-balanced naval establishment was given up years ago by all first-rate naval powers. The reasoning which led to the abandonment of small craft similar to the former torpedo-boat was correct, from the point of view of the use that could be foreseen for such vessels at that time.

However, the rôle played by the submarine, even in the early stages of the European war, brought about new conditions. The destroyer and cruiser forces of the Allied powers were found inadequate for effectively patrolling the waters of the war zone and for combating the activities of the submarine. Pleasure craft and small commercial vessels of all descriptions were converted by Great Britain to this use, so far as possible, by mounting guns of such caliber as could be carried and as were available. Early in 1915, the British Government placed a contract with an American company for 550 motor boats, for the purpose of augmenting the patrol forces of the British Navy. These boats had the following characteristics:

Length, 80 feet.
Beam, 12 feet 2 inches.
Draft, 4 feet 6 inches.
Speed, 18 knots.
Machinery, two 220 H. P. gasoline engines, built by Standard Motor Construction Company.

over or around a rain-squall or mist, and still have good visibility. If fog is encountered, it should always be run away from, or if in a proper place, a landing made before it closes in. On any patrol, if fog or heavy clouds are encountered, different altitudes, determined beforehand and at least 500 feet apart, should always be taken at once to avoid collision.

IV. REPORTING ON MOVEMENTS OF ENEMY OVER SMOKE SCREENS, IN LOW VISIBILITY AND OVER THE HORIZON

Reporting enemy's movements overlaps scouting, but reports when in contact or almost in contact with the enemy can be made by nearly any type of aircraft including heavier-than-air craft, dirigibles and balloons. The great value of aircraft for this work was proved in many maneuvers in the Grand Fleet. Many times when the fleet was absolutely blinded, due to smoke, poor visibility or distance, all the information desired by the admiral was sent down from the air. Types of ships, formations, base courses, changes in base courses, etc., are easily seen. Radio telephones should always be used for all communication work up to their distance limit, and then radio telegraph. Visual signals are only secondary in case of radio failure.

V. DETECTING MINE-FIELDS, TORPEDOES AND SUBMARINES

In detecting mine-fields and submarines from aircraft, two factors must be considered: the clearness of the water and the condition of the atmosphere. Ability to see under water varies with these two factors. Under the most favorable conditions, such as can be found in the Caribbean, very clear water and a strong sun overhead, it is possible to make out a shape over 100 feet under water. In muddy water, such as the Chesapeake in the spring, nothing can be seen a foot under the surface, and under-water visibility varies between these two conditions.

In general, in blue water, mines can be picked up some fathoms under, especially if there is a bright sun behind, and submarines to a greater depth. Of course, submarines light or awash are easily seen and the V wake from a periscope is visible a long distance in moderately smooth water.

The wake of a torpedo is easily picked up, and if the aircraft is connected with the ship control by telephone, directions for avoiding it are of great assistance.

tional boats that have been designed on the principle of observing such a balance of characteristics as to make for seaworthiness and reliability of power plant.

The conclusions reached from the pre-war study of this subject have been fully borne out by experience with these craft in actual service. Some of the stauncher vessels were sent to the other side, but in general it may be said that the converted yachts which have proved suitable for naval service have been very few in number. Many of the smaller craft have, however, been found useful and necessary for patrol work in harbors and in partly enclosed waters on the Atlantic coast.

When it became apparent that our existing resources of this type of vessel would fall far short of the requirements in case the United States was drawn into the war, the Bureau of Construction and Repair took up the design of a vessel specially adapted for this service. On account of the shortage of steel construction capacity, all of which was needed for building destroyers and merchant vessels, it was decided that the boats would have to be built of wood. As wood construction presented a special design problem, the services of an eminent yacht architect, Mr. A. Loring Swasey, who later rendered invaluable service as superintending constructor for the United States Navy in the New York district, were obtained for this duty in the Bureau of Construction and Repair.

The most important characteristic for this type of craft was considered to be seaworthiness. This characteristic cannot be given to very small boats. On the other hand, in wood construction the limit of size beyond which the hull weight becomes excessive is soon reached. The best compromise was found to be a boat 110 feet in length over all. This length made it possible to incorporate in the design all of the essential service requirements and to make for a thoroughly seaworthy boat.

Considerable pressure was brought to bear from various quarters to build boats of smaller size, on the grounds that such boats could be produced in larger quantities in a given time. While this would have been true, it would have been equally sound to have manufactured air rifles for the army instead of Springfields. Before definitely rejecting the design of the 80-footers, which were built in the United States for England, the opinion of the British Admiralty on these boats was obtained. The comment

of the British Admiralty confirmed our opinion that the 80-footers were not sufficiently seaworthy for general service.

There was practically no choice as to the machinery installation. Steam engines were out of the question, because of the lack of capacity for building light weight propelling machinery in quantity. One make was briefly considered, but the production would at the best have been a matter of tens instead of hundreds of units in the time available. Even as to gasoline engines it was found that there was no choice, as the question of quantity production entered into the problem. It was found that only the Standard Motor Construction Company had both an acceptable engine as to design and suitable capacity for producing the numbers needed. Even at that the production of engines proved later on to be the limiting factor in turning out completed boats.

A triple-screw arrangement was adopted using three 6-cylinder 220 H. P. engines. While speed was not considered the most important characteristic of the boats, an endeavor was made to obtain a maximum speed of 17 knots. Due to the addition of many features which increased the displacement of the chasers beyond the design calculations this speed has not been reached in service, although on trials at the designed displacement the boats came up to expectations in this respect.

The requirement that the boat should be able to go to sea and to stay at sea in any kind of weather was considered the high spot in the design. As to this quality every expectation has been fulfilled. The 110-foot chasers are quick rollers, their period being about five seconds, but this is a characteristic which is fundamental to seaworthiness in a small vessel; otherwise, green seas over the bows become the rule instead of the rare occurrence. Many interesting reports have been received of these small vessels sticking to their convoys when larger escorting vessels were scattered and battered by heavy weather.

The design of the gasoline storage and supply system was given much attention. Any gasoline boat is a potential volcano. No matter how carefully the system may be designed and built—gasoline fuel is a hazard because carelessness is a common human failing. Fortunately, the serious accidents in service have been few. Such accidents as there have been can be traced to failures to observe the precautions that are necessary in dealing with this dangerous fuel. As this article may be read by someone who

has been living on a gasoline-driven boat so long without accident that he has forgotten that eternal caution is the price of safety, the most serious accident which has occurred on a chaser will be briefly recited:

Several months ago a 110-foot chaser was fueling at sea astern of a tanker. In order to accelerate the flow of gasoline the commanding officer ordered the manhole covers of the tanks removed, thus permitting the fumes to vent directly into the boat. This was the first mistake. Then also the radio operator was directed to stand by to receive or to send messages. This was the second mistake. While taking on gasoline the commanding officer should have forgotten that he had a radio outfit on board. The operator received a call and went below to take the message. On completion of the message he opened the motor-generator switch. An explosion followed which killed several men and injured others.

The two principles which underlie all precautionary measures with respect to gasoline are: First, to prevent the accumulation of gasoline fumes inside of the boat; and second, to avoid sparks and open flames in localities where gasoline fumes are likely to be present. The first principle requires the venting of tanks into the open atmosphere, the closing of all doors, hatches and airports while taking on gasoline to prevent vapors given off by the vents and filling pipes from creeping along decks and penetrating through such openings into the boat; keeping the bilges clean and free from gasoline; and inspecting the piping system and tanks frequently to detect leaks. The danger from sparks and open flames in the vicinity of gasoline vapors is obvious. All of these matters are fully covered by regulations and instructions. It seems like an elaboration of the obvious to invite attention to these precautions. If these precautions were always observed a gasoline installation would be practically as safe as a steam installation, but it is human to become careless.

The armament originally contemplated for the chasers consisted of one 6-pounder and two machine-guns. After the design had been practically completed this was changed to two 3-inch and two machine-guns. Later on a depth bomb projector was substituted for the after gun. There was some question as to whether the armament of the chasers would be effective against submarines. A demonstration of the adequacy of the 3-inch gun was afforded at Durazzo where the chasers sank an Austrian

submarine by gunfire. The depth bomb, however, proved to be the most effective weapon of the chasers, as there was seldom an opportunity to use the gun against submarines. It was assumed that a submarine would not consider it worth while to engage in a gun duel with a chaser, as the risk would have been out of proportion to the result which the submarine would accomplish in destroying so small a vessel as a chaser.

The principal characteristics of the 110-foot submarine chasers as finally adopted are as follows:

Length, 110 feet.
Beam, 15 feet $4\frac{3}{4}$ inches.
Draft aft, 6 feet 3 inches for displacement of 75 tons.
Mean draft, 5 feet 3 inches for displacement of 75 tons.
Freeboard forward, 9 feet 9 inches.
Freeboard aft, 4 feet 1 inch.

Propelling machinery:

Three 6-cylinder standard marine gas engines.
Bore, 10 inches; stroke, 11 inches.
B. H. P., 220; R. P. M., 460; weight, 6300 pounds each.
One 2-cylinder $4\frac{1}{2}$-inch x $5\frac{1}{2}$-inch Auxiliary engine driving a $4\frac{1}{2}$-K. W. dynamo and pumps.
Speed at displacement of 66.5 tons:
One engine at 370 R. P. M., 9.4 knots.
Two engines at 460 R. P. M., 14.25 knots.
Three engines at 460 R. P. M., 16.85 knots.
Cruising radius at 10 knots, 900 miles.
Fuel capacity, 2400 gallons of gasoline.
Fresh water capacity, 945 gallons.

Armament:

One 3-inch 23-caliber gun.
Two machine-guns.
One depth charge projector.

Complement:

Two officers.
Twenty-four men.

Contracts were placed for the construction of 355 chasers toward the end of March, 1917, shortly before the United States declared war on Germany. This number included 135 ordered

to be built at navy yards. The program called for delivery of all of the boats by January 1, 1918. While a number of the boats were not completed until after this date, due principally to the difficulties encountered by the Standard Motor Construction Company in making engine deliveries, the program was completed so close to schedule time that it is believed to be unique in this respect as compared to other war programs of equal magnitude.

The construction of so large a number of boats in less than a year was possible only by the closest co-operation between the bureaus of the Navy Department, the builders, and the inspectors —the last mentioned in many cases having to assume the functions of management at the building yards in order to expedite the work.

There is always an element of chance in venturing on a very large duplication program without building a pattern boat to correct omissions and conflicts in the plans. It is impossible to reduce to drawings in advance of construction every detail of a ship design of an entirely original type, especially when time is the essence of the undertaking. In the case of the 110-foot chasers the risk had to be taken of proceeding at full construction capacity without awaiting the completion of one boat. However, the next best substitute for building a complete pattern boat was adopted by pushing one of the chasers at the New York Navy Yard ahead of the rest.

The New York Navy Yard was given an order to proceed with the construction of 60 chasers on March 19, 1917. The first boat was launched on May 7, 1917. On May 9, 1917, the gun firing trials were held on this boat—50 days after the order to proceed with the work was received by the yard. This was a remarkable piece of work, as the yard had to purchase practically all of the materials for the job, many plans had to be made and details of construction had to be perfected.

The design of the gun foundations was of particular importance, as it was necessary on the one hand to avoid excessive weight and on the other hand to provide an adequate structure for properly distributing the recoil stresses to the hull of the boat. There was no past experience to draw on, as the installation of a 3-inch gun on a wooden boat of light construction was a new departure. The first boat was so rapidly completed at the New York yard that no delays in the program resulted from

Admiral Fiske's Idea Being Put Into Effect.

blowers, etc., would set a limit on the efficiency of listening devices. In the case of the 110-foot submarine chasers none of these handicaps exist. The engines and auxiliary set can be stopped in a moment, the lighting system and blowers under these conditions taking their power from the storage battery. This leaves no running machinery except the blowers. These can be stopped for such periods of time as necessary without discomfort. A mounting was eventually developed for the forward blower which insulates the sound from the listening device so that it can be kept running continuously.

From several points of view, the 110-foot submarine chasers are the ideal type of craft for hunting submarines. As mentioned above, the suppression of local sounds offers no difficulties, thus permitting the use of the listening devices at maximum efficiency. The boats can be stopped from full speed ahead in less than two boat lengths. The turning circle is very small and the maneuvering facilities are therefore ideal for this work. In this connection it may be mentioned that the destroyers were often considerably handicapped in making depth bomb attacks on submarines because of their large turning circles.

The tactics used by the 110-foot chasers in hunting submarines were as follows: Three chasers worked together, running in line abreast at about 400-yard intervals. On signal, all of the vessels stop, lower the listening tubes and take a bearing of the submarine sound. The two wing boats transmit the bearings by wireless telephone to the center boat, which is the flag boat, the center boat having in the meantime also taken a bearing of the submarine. A three-arm plotting board is used for plotting the position of the sound, this being at the intersection of the three bearings. The boats then proceed at a directed speed to the position of the submarine as plotted. On arrival at this position, the boats stop, lower their tubes, and take another bearing. This procedure is continued until the chasers reach a position within a few hundred yards of the submarine. By this time the group commander can make a fairly close estimate of the speed and course of the submarine. The depth bomb attack is begun by dropping a pattern which will include all of the area in which the submarine is likely to be at the time—the formation of the boats being shifted accordingly. After each pattern, the chasers again listen in to determine whether the submarine is still under way. If the water

is shallow the submarine will probably lie motionless on the bottom. A trailing device is in use on the chasers which is supposed to indicate when it is dragged across the submarine.

Chaser tactics in hunting submarines would no doubt have been developed to a high degree of efficiency had the war continued. To meet the contingency of a submarine coming to the surface to attack by gunfire instead of making an attempt to escape under water, the plan was being worked on at one base of using a destroyer as a killer to accompany a certain number of chasers, acting as the hunters only, with the idea that should the submarine come to the surface, the destroyer's gun power would be available to deal with the situation.

As the need for patrol craft was particularly urgent on the coast of France, the first 50 vessels to be completed were turned over to the French Government. These boats crossed the Atlantic in winter weather and to a considerable extent under their own power. They were towed part of the way, as their fuel capacity was not sufficient to carry them across. Later on, special arrangements were made on several tankers for fueling the chasers on the way across. This proved to be more satisfactory than towing.

One of the chasers in the first group taken over by the French became separated from the convoy, due to an engine breakdown. After repairs had been made, the chaser failed to catch up with the convoy and had further machinery trouble. The supply of lubricating oil then ran out. Olive oil and butter were used as a substitute, so far as available. Finally, the gasoline supply became exhausted with the chaser still hundreds of miles from port. The commanding officer then made a sail from blankets, sheets, and pieces of canvas and finally reached port after being on his own for almost a month. After this, all of the chasers were equipped with a sail.

Just how the chasers managed to stow all of the gear which was added from time to time is a mystery. However, the problem of stowage room was of smaller concern to the designers than the constantly increasing weight of the boats. Nothing grows so fast as the displacement of a small boat. The designed normal load displacement of the chasers was 54 tons. This has grown to approximately 84 tons for full load condition. The increase in displacement started with the change from a 6-pounder to a 3-inch gun, then the addition of an extra 3-inch gun, the change to the

effect on the latter that the wings collapsed and the pilot was hurled to sudden death. In another case when the torpedo had been discharged, it hit the water at an awkward angle, and ricochetting over the surface, rose and demolished the aeroplane which had not risen out of the way. This discharging of a torpedo was no light risk when the torpedo was of full size, weighing anything up to a ton—three times the weight of the machine in which Blériot first crossed the English Channel.

A good deal of practice and patience was needed to make torpedo attacks from aeroplanes a success, and it is a tribute to the indomitable perseverance of our naval pilots that they have at length developed some formidable squadrons with special efficiency in this new work. These wonderful aeroplanes can go up from land or from the deck of a ship, and can descend on the sea and float until help is brought by wireless. When the German Fleet surrendered, an aeroplane "mothership" with 20 of these machines in its bosom met the Huns 50 miles out at sea, and had any tricks been tried it would have been simple work for a score of mystery aeroplanes to have leapt into the air and torpedoed the best part of the ships. This mystery or "Cuckoo" aeroplane—so called because of its weakness for laying eggs in other people's nests—is one further testimony to British engineering ability and resourcefulness of our navy.

REAR ADMIRAL FISKE INVENTED THE TORPEDOPLANE

Rear Admiral Bradley A. Fiske, U. S. N., conceived the idea of a torpedo-carrying aeroplane in the winter of 1910-1911 as a means of defending the Philippine Islands, and discussed the idea with the General Board of the navy. He was in charge of the "War Plan Section" of the General Board, U. S. Navy, and in that capacity suggested that the Philippines could be defended against invasion by means of a large number of aeroplanes which would drop bombs on enemy boats going ashore from the transports and on men who might be landed, and that by using aeroplanes of a larger size it would be possible to drop torpedoes from them which would sink the men-of-war and the vessels of the invading fleet.

In April, 1912, Rear Admiral Fiske applied for patent on the torpedoplane, which was granted in July, 1912, by the U. S. Patent Office.

THE ITALIAN EXPERIMENTS OF 1912

The Italians were the first to make experiments in dropping weights from an aeroplane, with a view of evolving a method of launching torpedoes. Captain Alessandro Guidoni, Royal Italian Navy, using a 1910 Farman biplane equipped with floats, made a number of experiments at an Italian naval base in 1912-1915.

Name	Address	Boats and numbers: First contract	Second contract (for French government)	Third contract
New Orleans Naval Station	New Orleans, La.	1–4	....	443–444
		114–115	....	....
New York Navy Yard	Brooklyn, N. Y.	5–64	....	....
Mathis Yacht Bldg. Co.	Camden, N. J.	65–74	381–385	426–430
		209–213	....	....
Hiltebrant D. D. Co.	Kingston, N. Y.	75–89	371–375	421–425
Elco Co.	Bayonne, N. J.	90–105	361–364	....
Charleston Navy Yard	Charleston, S. C.	106–113	....	....
Norfolk Navy Yard	Norfolk, Va.	116–136	....	....
Hodgdon Bros.	E. Boothbay, Me.	137–138	....	....
Hartman-Greiling Co.	Green Bay, Wis.	140–141	....	....
Rocky River D. D. Co.	Rocky River, Ohio.	142–143	403–406	437–438
Vinyard S. B. Co.	Milford, Del.	144–146	....	....
L. E. Fry & Co. (E. J. Wright)	Clayton, N. Y.	147–148	....	....
		337–338	....	....
Dubuque Boat & Boiler Wks.	Dubuque, Iowa	149–150	....	....
Gibbs Gas Engine Co.	Jacksonville Fla.	151–155	365–370	....
		204–208	....	....
F. M. Blount	Pensacola, Fla.	156–159	....	....
Howard E. Wheeler	Brooklyn, N. Y.	160–168	....	339–441
Matthews Boat Co.	Port Clinton, Ohio.	169–178	386–392	431–433
International S. B. & Marine Eng. Co.	Upper Nyack, N. Y.	179–188	....	....
General S. B. & Aero Co.	Washington, D. C.	189–203	....	....
Alexander McDonald	Mariner's Harbor, L. I., N. Y.	214–217	....	434–436
Newcomb Life Boat Co.	Hampton, Va.	218–222	....	....
N. Y. Yacht, Launch & Engine Co.	Morris Heights, N. Y.	223–242	393–402	....
Eastern Shipyard Co.	Greenport, N. Y.	243–247	....	....
Camden Anchor-Rockland Machine Co.	Camden, Me.	251–252	....	407–408
Geo. Lawley & Son	Neponset, Mass.	253–272	....	....
Mare Island Navy Yard	Mare Island, Cal.	273–287	....	....
Puget Sound Navy Yard	Bremerton, Wash.	288–312	....	....
Robert Jacob	City Island, N. Y.	313–317	....	....
Luders Marine Const. Co.	Stamford, Conn.	318–322	....	....
Kyle & Purdy	City Island, N. Y.	323–327	376–380	....
Great Lakes B. B. Corp.	Milwaukee, Wis.	328–329	....	419–420
Burger Boat Co.	Manitowoc, Wis.	330	....	....
Smith & Williams Co.	Salisbury, Md.	331–332	....	....
Barrett S. B. Co.	Mobile, Ala.	333–336	....	....
American Car & Found. Co.	Wilmington, Del.	339–346	....	....
College Point Boat Corp.	College Point, N. Y.	347–356	357–360	413–418
Clayton S. & B. Bldg. Co.	Clayton, N. Y.	....	....	411–412
Chance Marine Const. Co.	Annapolis, Md.	248–250	409	....

a general estimate of the situation had been made, a design was prepared by the Bureau of Construction and Repair of what are now called the eagle class of boats. The construction of the boat was simplified in every possible way, having in mind that the Ford Motor Company were not shipbuilders and needed every consideration in the way of simplified construction to facilitate the work.

The boats have the following general characteristics:

Length, 200 feet.
Beam, 25 feet 6 inches.
Draft, 7 feet 3 inches.
Normal load displacement, 500 tons.
Single screw, turbine driven.
Normal shaft H. P., 2000.
Overload shaft H. P., 2500.
Speed, 18.3 knots.
Cruising radius, 3500 miles.
Armament: Two 4-inch 50-caliber.
One 3-inch 50-caliber anti-aircraft.
One depth bomb projector.

The Ford Motor Company was directed in January, 1918, to proceed with the construction of 100 of these boats, to which number 12 more were added later on for the Italian Government. Since the signing of the armistice this number has been reduced to 60. A shipbuilding plant was erected at River Rouge on the outskirts of Detroit for fabricating and assembling the hulls. The machinery and fittings were largely built at the Ford Motor Company's plant, Highland Park, Detroit. The contract called for the delivery of 100 boats by December 1, 1918. While only seven of the boats left the plant before the close of navigation, the performance of the Ford Motor Company in completing even this number is creditable when one considers that this company had had no previous experience in shipbuilding and made practically no call on the shipbuilding industry for assistance. This latter policy is considered by some to have been a mistake, as the work could have been very materially accelerated had the contractor employed a sufficient number of men skilled in the various shipbuilding trades to act as instructors for his men. Great credit is due Mr. Charles C. West, the superintending constructor for the navy, and to Commander Carlos Bean, U. S. N., inspector

If this is true the German aviators must have been inexperienced, because it would have been very easy to have gone around the flank of the barrage and attack the destroyers from an unexpected direction.

U. S. EXPERIMENTS

Until 1917 the subject of torpedoplanes was discussed in this country from time to time, but as Mark Twain said about the weather, "Everybody talks about it, but nobody does anything about it," nothing was done to give the United States the torpedoplanes needed to meet an emergency.

Late in 1916 the Board of Governors of the Aero Club of America, after taking stock of the military resources of the United States, came to the conclusion that, owing to our small army and navy and general unpreparedness, the only hope of success on the part of the United States in case of war would be in developing some powerful new instrument which would give us predominance. A committee consisting of Messrs. Alan R. Hawley, Henry A. Wise Wood, Rear Admiral Robert E. Peary, and the writer, made an investigation with the purpose of finding one or more new instruments, the value of which would be so great that they would give predominance to the side which employed them. After looking over the field of inventions, the committee came to the conclusion that the torpedoplane patented by Rear Admiral Bradley A. Fiske in July, 1912, was a revolutionary invention of tremendous possibilities.

The committee then asked Admiral Fiske to deliver an address on the subject, which he did at the Aeronautic Conference held in connection with the First Pan-American Aeronautic Exposition, Grand Central Palace, New York City. Admiral Fiske's address on that occasion is printed elsewhere. It created considerable interest, and, as a result, a fund of $2500 was set aside for the purpose of defraying the expenses of the experiments of developing the torpedoplane. Admiral Fiske was asked to be chairman of a committee to supervise the work of developing the torpedoplane, and he appointed the following as members of his committee: Alan R. Hawley, Henry A. Wise Wood, Rear Admiral Peary, John Hays Hammond, Jr., F. Trubee Davison, Schuyler Skaats Wheeler, Frank M. Leavitt, Lawrence B. Sperry, and the writer.

lar problem which had to be solved. The following is a comparison of the approximate cost in 1918, and the man power required to operate these three types of vessels:

	110-foot chasers	boats	Destroyers
Approximate cost, including armament	$80,000	$486,000	$1,800,000
Ratio of cost	1	6	22.5
Complement, officers and men	26	72	133
Crew ratio	1	2.8	5.1

Assuming that a periscope can be seen as far from the bridge of a chaser or an eagle boat as from the bridge of a destroyer, and this is believed to be a correct assumption, the ratio of sea area covered by the three types of vessels is about 1:1.2 and 2.3, based on the speed of each type. Applying this ratio to the cost it will be noted that per dollar of investment a 110-foot submarine chaser covers approximately 10 times as much area as a destroyer and that an eagle boat covers about twice as much area as a destroyer. The man power for operation is also in favor of the smaller vessels.

Any discussion of the relative value of destroyers versus smaller ships, such as the 110-foot chasers or eagle boats for escort and patrol duty, may perhaps now be considered academic, because the submarine will probably never again play the rôle that it did in the Great War. As units of a fleet in action it is doubtful whether any surface craft smaller than a destroyer is a good investment. However, off-shore patrols will always have to be maintained in case of war with a sea power.

Our experience with the 110-foot chasers has demonstrated that patrol vessels capable of going to sea and staying at sea in any kind of weather can be provided at a cost far below the price of destroyers, both as to original cost and as to man power required for operation. It has also been demonstrated that it is not possible to augment the destroyer force quickly, whereas it is possible to build large numbers of smaller craft suitable for patrol work in a short space of time. One year from the declaration of war three hundred and fifty 110-foot chasers had been added to the navy list, whereas only seven new destroyers had been commissioned.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE RADIO COMPASS

By Ensign Bowden Washington, U. S. N. R. F.

The radio compass (radio pelorus would perhaps be a better name, as it always gives relative bearing, except ashore) is a device for determining the direction of a distant radio transmitter, and, granting that this object is attained, would seem to have considerable value for both navigational and military purposes. The present type of U. S. Navy radio compasses, though a comparatively new device and one which can be subject to tremendous improvement, is, if properly operated, a thoroughly practical piece of apparatus. It has been the writer's experience that, on the ships equipped with the radio compass, generally very little use has been made of it, and, it is believed, that owing to several causes, matters not inherent to the apparatus itself, it has come rather into disfavor. The writer hopes in these few notes to point out what he believes these causes to be and their remedies. From having installed, tested and operated probably 50 radio compasses on battleships, cruisers, destroyers, chasers and ashore it is natural that one should develop considerable interest in the device, and its operation, when in competent hands, has led to the development of faith in its performance as well.

The fundamental principle of operation is exceedingly simple, as is the apparatus itself if looked upon in the proper light. It is known to any one familiar with elementary physics that if a coil of wire is passed edgewise between the poles of an electromagnet, a potential is set up in this coil, and if the circuit in which this coil is inserted is closed a current will flow. This is really the fundamental principle of the dynamo. On the other hand, if the coil is passed between the poles of the magnet in such a position that its plane is the same as that of the magnetic lines of force between the poles, the potential induced will be in opposite directions in opposite sides of the coil and no current will flow. It can be readily seen that the above is true

What better weapon can we find for the defence of our coasts and island possessions?

An enemy fleet bent on attack or carrying an invading force would have to contend with large torpedoplanes before it could come within 1000 miles of our shores and with smaller torpedoplanes launched from aerodrome ships, such as are recommended by Admiral Rodman.

Our island possessions will be most powerful as torpedoplane *bases,* almost invulnerable.

Is this not truly revolutionary in its prospective developed stage?

within 3° or 4°). A great deal of this sort of thing could be eliminated by inserting insulators in all wire rigging over, say, 50 feet in length.

Little or no trouble of this sort is experienced on destroyers, the rigging being comparatively short, and cage masts seem to be less objectionable than would at first be supposed. An idea of the degree of accuracy to be obtained on destroyers may be obtained from the following:

The writer, aboard one of the new boats, when about 10 miles off Provincetown, took bearings on the Boston Radio Station and on New York Navy Yard. The former was within 1°, the error of the latter was found to be 4°.

Not long ago, the writer went aboard 17 destroyers lately returned from European waters, all equipped with radio compasses, and interviewed the commanding officers, radio officers, and electricians in charge. Most of these ships had had their apparatus installed on the other side. It was learned that only three had made any real use of the radio compass. These three ships will be referred to again as an example of what can be done. There appeared to be several reasons for this poor showing. In a great many cases the apparatus was never tried until it was actually needed. The men had therefore no practice in its use, and it failed. Also, on these same ships it had not been used for long intervals and therefore was in poor condition when needed. (The radio compass requires no more, no less, care or intelligence than the ordinary receiving set.)

On one ship the compass room had been used as a potato locker.

In general, the operators had had little or no instruction in its theory or use, and seemed to believe it to be complicated and difficult to understand; when, as a matter of fact, any second-class radio electrician who deserves his rating and is therefore fairly familiar with ordinary radio receivers should be able to master both theory and practice in perhaps two hours.

Another thing which made against the efficient working of the device was the addition by the various radio electricians of other apparatus in an effort to "copy press," etc.

It was evident also in some cases that the chief electrician (radio) had belittled its value in an effort to get out of an extra watch and an extra station to look after.

It is natural that no confidence should be felt in the apparatus until it has been demonstrated to work reliably.

It is believed, however, that if the electrician on watch is required to take several bearings during each watch on stations of known position and report these bearings to the bridge to be checked it will not only afford excellent practice for the operator, but will eventually demonstrate to the navigator the value of the apparatus. If good bearings are not obtained, and the apparatus has been properly installed in the first place, it can be attributed to extreme stupidity, or lack of trying, on the part of the operator. One instance can be mentioned as an indication of this fact. After completion of a shore radio compass station, two of the permanent crew arrived and were instructed for perhaps half an hour by the writer. Upon returning about three hours later they were found to have taken probably 30 cuts on land stations along the coast, most of which checked up within 3° or 4°, the worst error being in the neighborhood of 8°.

On a coast station at Gloucester, Mass., cuts have been repeatedly made on stations as far as Cape Race and Halifax, Bermuda and Key West which were consistently accurate within 6° or 8°, and stations within 100 to 150 miles would repeat to a degree.

It may not be out of place to mention now a few of the uses to which the radio compass was put by the ships that really used it. Two enemy submarines were located. In both cases the destroyers were with convoy, and could not attack, but the fixes obtained were afterwards verified by the British. One destroyer made port three times in fog by means of her radio compass. A torpedoed transport was found at a distance of 27 miles. Contact with other warships was established frequently. Convoys were picked up when off their rendezvous. One ship, as a check, took cuts on land stations when 150 miles out from Brest. These came within three miles of their noon sight. Too much reduction in speed from the original engine calibration was made when allowing for listening-gear drag, and when returning from abroad Nantucket Shoals Lightship was found to be abreast instead of 65 miles ahead as expected from dead reckoning.

It must be remembered that all these ships had identical apparatus, were in many cases identical ships, and had average enlisted radiomen. The only outstanding difference between the three ships whose performances are recorded above and the remaining 14 was that in each of these three ships one officer, at

least, believed that the radio compass would work and insisted that it should work.

One cannot but feel that the radio compass, as an aid to navigation, will develop into something of considerable value. Stations are now under construction in the vicinity of several important harbors along the Atlantic coasts. These should be of some service in bringing ships in which have been forced to make a long passage with no opportunity to check their dead reckoning, and, if properly operated, would, even in the event of a ship having been able to get plenty of sights, be an additional safeguard. The best mode of operation would seem to be to have these stations take simultaneous bearings when requested and transmit these bearings by land wire to a central radio transmitting station, equipped with a chart having a compass-rose at each radio compass station and a rule pivoted at each. Four compass stations for a port of the importance of New York or Boston would seem desirable. The central station could then almost instantly determine the ship's position and send it to her by radio. It has been suggested that each compass station be equipped with a transmitter, but this plan seems to have some objectionable features; namely, the cuts cannot be checked against each other by an experienced radioman who knows from experience their relative values. Each station will have to send its reading separately, thereby creating more radio interference. I believe it to be somewhat questionable if merchant skippers on small ships will very frequently go to the trouble of getting a fix, but would probably be delighted to use it if given them.

I think it may be confidently stated that even in the present state of the art, shore radio compass stations can be built, if sufficient care is taken, which will give cuts within $\frac{1}{2}°$ to a ship equipped with a 5-kilowatt transmitter at a distance of 400 miles.

In summary, it might be said that experience has led me to believe that the radio compass in its present state is a practical and valuable device and, if no results are obtained, it rests entirely with the personnel concerned, directly or indirectly.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ELECTRIC CHLORINE INDICATOR

By Lieut. Commander P. V. H. Weems, U. S. Navy

The navy standard water testing outfit has been indispensable, yet if an electric indicator could be sufficiently developed to do the work of the former, there would be considerable saving in: (a) Chemicals; and (b) the time necessary for making the tests. There are now on the market accurate and elaborate water testers, but none seem to be practical for use abqard ship.

To obtain accurate data for developing a suitable electric indicator for the chlorine in water, it was necessary to run several tests. These tests gave the most promising results, as shown in Figs. 2 and 3. The complete apparatus is shown in Fig. 1. In a glass tube, 1½ inches in diameter, were fitted terminals of ⅛-inch brass wire, 1 inch apart, and 8 inches long. Two 60-watt Mazda lights connected in parallel were used as the pilot lights in the actual tests, but one light of the proper size would be preferable.

Water containing varying amounts of chlorine was poured into the tube till the pilot lights showed a faint glow, then the height of the water in tube and the ammeter readings were taken. These readings were taken only as a check, for the amperage for each test was approximately .12 amperes. With the height of the water in the tube, or with what is the same thing, with the immersion of the terminals as the ordinates, and with the number of grains of chlorine per gallon as the abscissæ, a curve was plotted. Since the conductivity of water varies with different temperatures, tests were made with the water at different temperatures. These results are shown in Fig. 3. Curves were also plotted (Fig. 2) with the immersion of the terminals as ordinates and with the temperature of the water as abscissæ. Water containing different amounts of chlorine was tested, giving the different curves, as shown in Fig. 2. This curve gives

the better results when the temperature of the water and immersion of the terminals are known and it is desired to measure the chlorinity.

To obtain the amount of chlorine in water where it is unknown, fill the tube till the pilot lights glow faintly, read the amount the

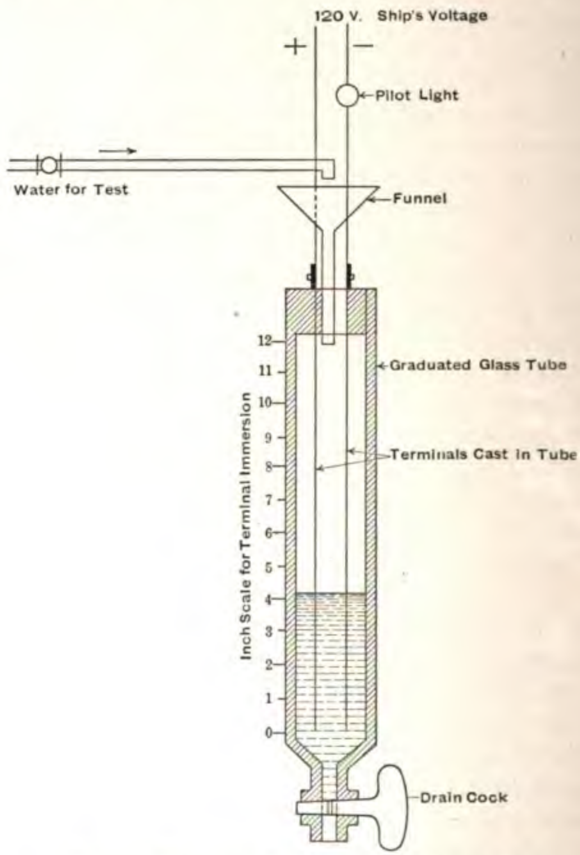
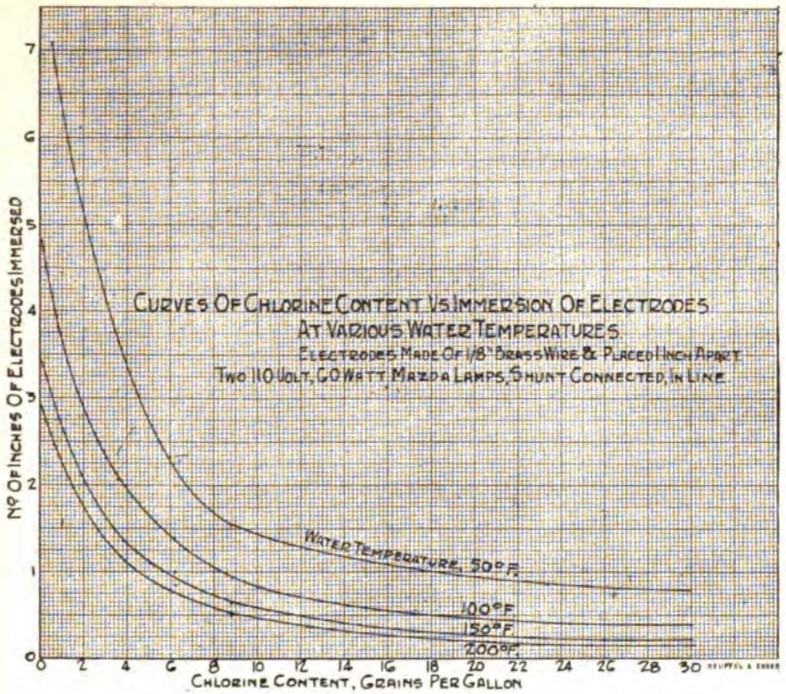
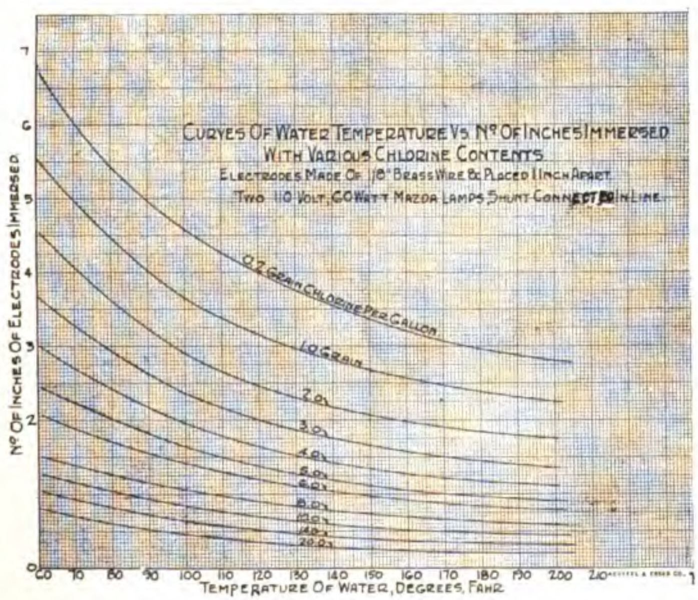


FIG. 1.—Diagram of Electric Chlorine Indicator.

terminals are submerged, then, knowing the temperatur water, pick off on the curves (Fig. 2) the number of g chlorine per gallon.

The electric chlorine indicator does not, of course, disc between one kind of substance and another; analysis


CURVES OF CHLORINE CONTENT VS IMMERSION OF ELECTRODES
AT VARIOUS WATER TEMPERATURES.
ELECTRODES MADE OF 1/8" BRASS WIRE & PLACED 1 INCH APART
TWO 110 VOLT, 60 WATT MAZDA LAMPS, SHUNT CONNECTED, IN LINE
WATER TEMPERATURE, 50°F.
100°F.
150°F.
200°F.
Nº OF INCHES OF ELECTRODES IMMERSED
CHLORINE CONTENT, GRAINS PER GALLON
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
0 1 2 3 4 5 6 7


CURVES OF WATER TEMPERATURE VS Nº OF INCHES IMMERSED
WITH VARIOUS CHLORINE CONTENTS
ELECTRODES MADE OF 1/8" BRASS WIRE & PLACED 1 INCH APART
TWO 110 VOLT, 60 WATT MAZDA LAMPS, SHUNT CONNECTED IN LINE
0.2 GRAIN CHLORINE PER GALLON
1.0 GRAIN
2.0
3.0
4.0
5.0
6.0
8.0
10.0
14.0
20.0
Nº OF INCHES OF ELECTRODES IMMERSED
TEMPERATURE OF WATER, DEGREES, FAHR.
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
0 2 3 4 5 6 7

do that. But in most instances in which water testing is carried out for marine engineering purposes, the substance present in the water is chlorine. Such tests are not made for purposes of analysis, but usually to find out the amount of chlorine that is present in the water; and in this case the electric chlorine indicator gives the required information with a rapidity and simplicity unapproached by any chemical test.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE UNITED STATES NAVAL PROVING GROUNDS

By Lieut. Commander C. L. Lothrop, Jr., U. S. Navy

Purpose.—Many of the younger officers of the service are unfamiliar with either theory or practice at the Naval Proving Grounds, and this paper is presented with the intention of reminding them of the vital necessity of the station's existence. It is also desired to bring up to date existing publications on the subject. The larger portion of navy ordnance must pass through the proving grounds before issue to the service, and upon their efficiency depends directly the efficiency of most of the material supplied by the Bureau of Ordnance.

To visit the proving grounds for at least a casual inspection should be part of the education of every officer; but a natural confusion as to what is going on is almost inevitable unless a clear conception is borne in mind of the purpose of the station. It may be likened to the testing laboratory of a large manufacturing plant, in which is tested, *in accordance with specifications,* all the material which goes into the finished product.

Similarly, all guns, mounts, projectiles, powder, fuses, ammution details and armor are tested, *in accordance with specifications,* at the proving grounds. Such specifications are laid down from time to time by the Bureau of Ordnance, and are compiled to include the best and latest ideas of the service and of ordnance engineers of this and foreign countries. If the material passes the prescribed tests satisfactorily, it is accepted; if it fails on any of the prescribed tests, it is rejected.

The desirability is thus indicated of having officers, both afloat and ashore, communicate with the bureau in regard to ordnance material which does not function perfectly, in order that such defects may be corrected in future types. This statement may seem too axiomatic to older officers of the service, but it cannot be too strongly impressed upon the younger members, whose tendency is to "make it work" and then forget that others may be experiencing similar troubles.

New devices are also tested at the proving grounds, and the increasing growth of the experimental department shows clearly the opportunity and the urgent need for research work in ordnance and gunnery. New ideas and developments of material in the service should, in a similar manner to reports of defects, be submitted to the bureau for consideration.

Location and Size.—The United States Naval Proving Grounds consist of the upper station, situated at Indian Head, comprising a tract of land of 409 acres on the left bank of the Potomac River, about 25½ miles below Washington, and the lower station, of 1365 acres on the right bank of the Potomac, 41 miles below Indian Head. The former has a water range of 18,000 yards, and the latter 100,000 yards. The entire reservation at Indian Head includes about 882 acres, of which the larger portion is occupied by the United States Naval Powder Factory. The proving grounds are entirely separate in administration from the Naval Gun Factory at Washington, D. C., coming directly under the Bureau of Ordnance.

Data Observed.—The bread and meat of proof work are velocity and pressure. Other data are recorded, but a clear understanding of the methods of obtaining these two vital necessities is essential.

Measurements of Velocities and Pressures.—Velocities are obtained usually from the Boulengé chronographs, which measure the time interval between the successive cuttings, by the projectile, of screens composed of copper wire. The first screen is placed about 80 feet in front of the muzzle, and the second 50 meters further. Separate electric circuits pass through the two screens, and the interval between breaking the circuits of the first and second screens supplies a measure of time for the chronographs. This, taken in connection with the space between screens, gives the projectile's velocity at a point midway between. The velocity is reduced to muzzle velocity at the physical laboratory, located about 400 yards from the firing battery, and is reported to the officer conducting the proof.

Shells recovered sometimes have the marks of screen wires graven on the nose by their rapid passage through. Two marks are usually cut, forming an X, of which one angle is the meas of rotation between screens.

Pressures.—Pressures are obtained by the crusher gag Fig. 1) from the comparison of copper discs calipered

and after firing. At least three gages are used, but where special accuracy is desired, six or nine are used, making due allowance for consequent reduction of chamber volume. The gages are placed loose before firing in the rear of the chamber of a B. L. R. or the base of the cartridge case of a R. F. gun. The copper discs are made of uniform metal from which sample discs have been calibrated. For anticipated pressures above nine tons, discs having had an initial pressure of nine tons are used. For pressures below nine tons, unpressed discs are used, except when,

FIG. 1.—Successful Armor Plate After Test. Note Timber Structure and Sand Butt.

in experimental work, extremely low pressures are expected, when lead discs are used.

Types of Proofs.—Tests may be divided into the following:

1. Guns and breech mechanisms.
2. Mounts.
3. Powder.
4. Projectiles.
5. Fuses and tracers.
6. Armor.
7. Explosives.

8. Cartridge cases.
9. Primers.
10. Bombs.
11. Special work.
12. Experimental work.

Proof of Guns.—In accordance with specifications, every gun and breech mechanism must be tested with an overload pressure one and one-quarter times that which it will ever thereafter experience in service. Assurance is thus given that the gun will not

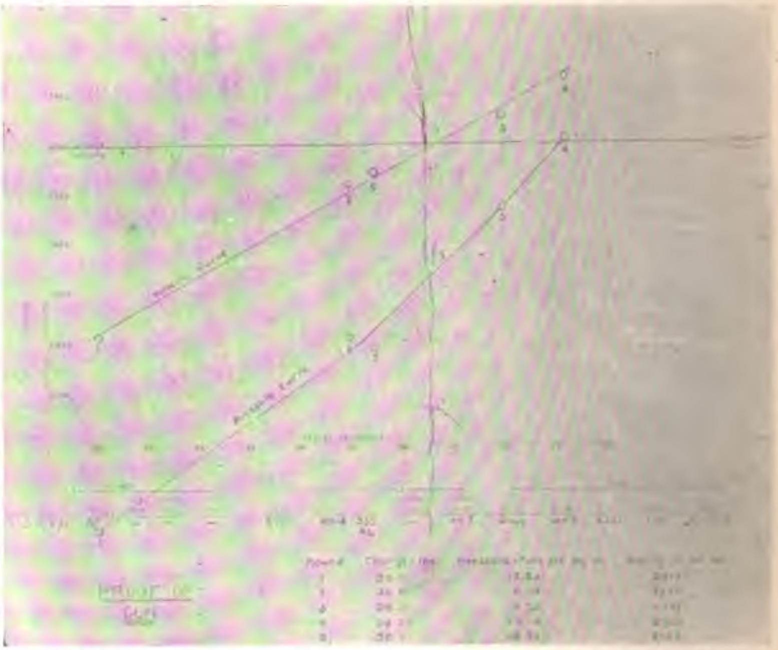


FIG. 2.—Plotting of Rounds Fired During Proof of Gun.

" blow up " on board ship. If a gun is weak, it is better to have it blow up at the proving grounds, where everyone is under shelter. As pressure is a function of the weight of charge, proof pressure is obtained by firing a charge heavier than the service charge.

When guns are completed, they are sent to the proving grounds, having been prepared in all respects for firing. By means of locomotive cranes for medium and minor calibers (see Fig. 2), and gantry cranes for major calibers (see Fig. 3), they are transported to the firing battery, where the mounts, or girders, are clamped to slotted gun circles. The gun, breech mechanism, fir-

ing mechanism and mount are then carefully inspected. Data as shown on firing record are collected and recorded in advance of firing, as regards the characteristics of the gun, mount, projectile, powder, ignition, primer, case, etc.

The officer conducting the proof refers to records, specifications and curves or graphs of previous firings of guns of the same type (see Fig. 4). These curves are plotted with the velocity and pressure as functions of the weight of charge. Having determined the charge to give three-quarters service pressure, he

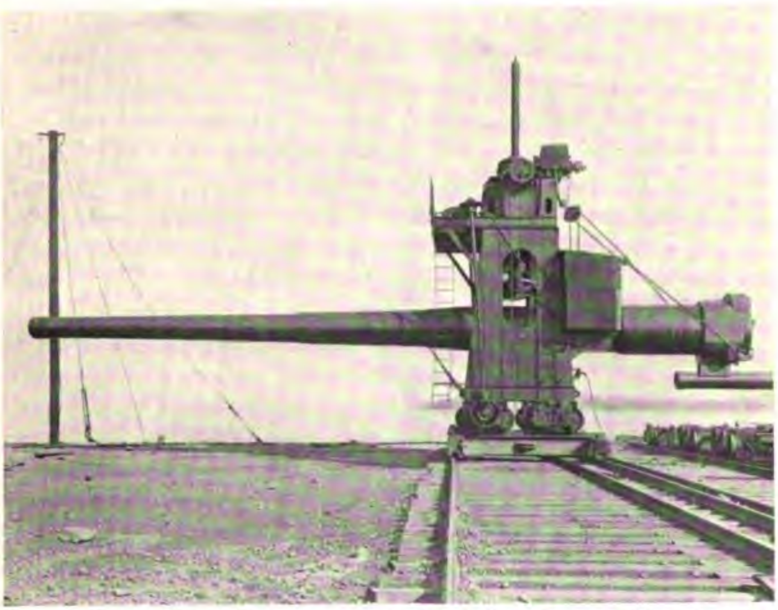


FIG. 3.—Gantry Crane Transporting Major Caliber Gun to Firing Battery.

weighs, checks and, after seeing that all personnel is under shelter, fires the charge.

Plotting, as a function of the weight of charge, the velocity and pressures actually obtained, the proof officer predicts the charge which will give service pressure and velocity. He then successively fires, plots and predicts the charges which will give just below proof pressure, and then proof pressure. In cases where doubt exists, a second proof round is fired. One more service round is then fired to relieve the strains set up by the proof round.

After firing each round, a thorough inspection makes certain that any defects which have developed are discovered. Records

are taken, noting particularly: (1) Cracks in screw-box liner, plug or at muzzle; (2) condition of rifling; (3) crawling of tube or liner, at breech or muzzle; (4) length of recoil and counter recoil; (5) condition of case or gas check; (6) condition of primer; (7) blow-backs; (8) signs of failure of mount; (9) special notes, as directed by the bureau.

When predicting charges above service from the velocity and pressure curves, the proof officer must exercise great care when passing the critical point in density of loading, as pressures will jump excessively when this is reached. Cases have been known where the addition of one-tenth of a pound over the "near proof" charge in a medium caliber gun has caused a 10-ton increase in pressure; *i. e.*, from 18 to 28 tons. As the highest specified proof pressure is 20 tons, the gun was thus subjected to a pressure three-quarters in excess of service pressure. To the credit of the gun, it is noted that no signs of strain appeared, except that the firing lock was wrecked. Attention is especially called, however, to the fact that such an occurrence could not happen by the addition of a small amount to the *service* charge, as the critical point for powders issued to service is always safely higher than around the point of service charge and pressure.

Indicator cards showing the work done by the recoil liquid during recoil and counter recoil are taken with Tabor indicators, and are of much assistance to the gun factory in connection with design and determination of proper functioning. The action of the indicator is similar to one on the cylinder of a reciprocating engine, as the recoil is analogous to the piston stroke, and the recoil liquid pressure to steam pressure.

In special cases, the velocity of recoil may be taken by the chronoscope.

Various guns are given special proofs, *in accordance with the specifications,* which have been developed from the needs of the service. For example, all S. A. guns are fired 10 rounds rapid fire.

After proof, the gun is returned to the Naval Gun Factory, where it is bore-searched and star-gaged, and stamped wi and the initials of the inspector of ordnance in charge proving grounds.

Proof of Breech Mechanisms.—Breech mechanisms on guns are proved with three rounds—service, proof, Rapid-fire test of new S. A. breech mechanisms is in addit

Proof of Mounts.—Mounts are ordinarily proved during proof of gun, but for proof, using a proved gun, three rounds are fired, working up to within a ton of proof pressure.

FIG. 4.—Locomotive Crane Transporting Two Guns to Firing Battery.

Proof of Powder.—*In accordance with specifications,* a sample of each index of smokeless powder is tested, before acceptance by the Bureau of Ordnance, to determine:

1. The weight of charge to give service velocity.

2. The weight of charge to give target practice velocity, in the case of powders for which a reduced velocity is used.

3. The service pressure per square inch.

4. The target practice pressure per square inch.

5. The regularity of a number of rounds, as shown by the mean variation.

Powder is always proved at a uniform temperature of 90° F. (32° C.). This temperature is reached by gentle heating, done in air-tight tanks to avoid loss of volatiles. If the power is for a R. F. gun, the cases used in the proof are also heated to the same temperature. When made up, the charges are exactly as issued to service, as regards ignition, bags, mouth cups, primers, etc. The projectiles used must be of the type to be used in service with the proof powder. Each is carefully measured and weighed before being brought to the firing battery.

The proof of a powder consists of the development of a velocity curve and a pressure curve, in the same manner described under "Proof of Guns." The officer conducting the powder proof examines the "characteristics" of the powder as reported on the accompanying description sheet, *i. e.*,

(a) Web thickness,

(b) Volatiles,

(c) Nitration,

and with these as a guide, consults the velocity and pressure curves of a similar powder. As hundreds of these curves are on file, and allowed variations in powder manufacture are small, approximately the same characteristics can always be found.

If the web of the proof powder is smaller than the reference powder, the former will be quicker; that is, will require a smaller charge for the same velocity. This may be remembered by reducing to absurdity, as, for example, a one-pounder powder is quicker than a 14-inch. If the percentage of volatiles of the proof powder is lower than that of the reference powder, the fo will be quicker; *rcductio ad absurdum:* a dry powder grain burn quicker than one soaked in water. If the nitration ot proof powder is higher than that of the reference powde former will be quicker. Aid to memory: gun cotton, wh a higher nitration than smokeless powder, is much quick

The proof officer can thus make his allowances before firing the low round, which starts the curves at 150 to 200 foot-seconds below service velocity.

Charges are then fired and plotted to run the velocity curve up to 100 foot-seconds above service velocity, unless the accompanying pressures indicate that excessive pressures may be obtained. Four rounds are usually fired, two of which are at or near service velocity.

An examination of the velocity and pressure curves faired through the plotted points gives the information noted in 1, 2, 3 and 4 above; 5 is determined by dividing the total variation of the plotted points from the faired curve by the number of rounds fired.

A small sample enclosed in an air-tight jar is taken during the proof from the proof sample and sent to the chemical laboratory for chemical and physical analysis, as to stability, nitration, volatiles, solubility, web, etc., all of which must be in accordance with the specifications.

After proof a report is forwarded to the Bureau of Ordnance, recommending either acceptance or rejection.

If the powder is accepted, an index number is assigned. This number, together with the manufacturer's lot number and the weight of service charge, is stencilled on the boxes, and the index is forwarded by the manufacturer to a magazine.

Proof of Projectiles.—The types of projectiles purchased for the navy are:

1. Armor-piercing.
2. Common.
3. High capacity.
4. Flat-nose.
5. Shrapnel.
6. Target.

Armor-piercing projectiles are tested in accordance with the specifications under which the contract was let, to ensure their satisfactory operation in service. They are:

1. Fired against plate.
2. Fragmented.
3. Ranged.

For test against plate the inspector at the works selects four projectiles from each lot manufactured. The test simulates the

extreme conditions as to angle of fall, striking velocity and thickness of plate which are anticipated in battle. The face-hardened armor plate used is one of a specified thickness which has previously passed test, and is set up on a heavy oak timber structure in front of a sand butt at a specified angle to normal. The posts of the structure are so set and the impacts so placed that the projectile will pass between the posts from the plate to the sand, without injury to the structure. A tube, shaped like an inverted **U**, (**∩**), is placed in front of the plate, and this, with flat cover plates, stops the spread of fragments.

The gun, about 100 yards from the butt, is bore-sighted on a chalk mark on the plate. Screens are placed in the line of fire to measure velocity, which in this case is calculated to give the striking velocity. A pasteboard screen is also used to record whether the flight of the projectile was true.

A charge of powder is chosen from curves of previous firings to give the specified velocity corresponding to the thickness of the plate at the point of impact. After all personnel is well under shelter, the projectile is fired.

Data as to the dimensions of the impact, flaking of the plate, penetration of the projectile, etc., are taken. Fragments of the projectile, if any are in front, are collected and weighed. Unless a second round at the same plate is to be fired at once, the projectile is then dug out of the sand by a bucket crane and after recovery is inspected, checked and photographed.

Two out of four projectiles so fired must be recovered in "effective bursting condition." A full report of the behavior of the test projectiles is forwarded to the bureau.

Four more armor-piercing projectiles are also selected from the first lot of each contract, of which three are ranged and one fragmented.

Projectiles are ranged by firing them at service velocity on a favorable day, from the highest powered gun for which they were designed, in a standard line of fire as laid by a theodolite, at an elevation of 8°. Under these conditions the mean di sion of several projectiles should be within the limits of the mal dispersion, as indicated by many firings at the Naval P ing Ground. The range should also be as great as that by the range tables. Both range and dispersion should al pare favorably with those of station projectiles of unifor acteristics fired at the same time.

Observers at favorable stations on the Potomac River cut in the splashes with theodolites. Their observations are plotted on a plotting board on which are permanently marked the observing stations. The exact position of each splash is thus located and the mean range and dispersion both of test and station projectiles obtained.

During firing the projectiles must not strip their bands, break up or flight erratically.

Projectiles are fragmented in an explosion chamber by exploding electrically a service charge of explosive in the shell cavity. The resulting fragments must be satisfactory in number, size and shape, in order that the maximum damage may be done when bursting on board an enemy vessel.

Common projectiles are tested by ranging and fragmenting a specified number of projectiles per contract, as described for armor-piercing projectiles. Plate test is against special treatment steel plate of a thickness and at a velocity laid down in the specifications for the contract. Projectiles are recovered from the sand butt behind the plate by a bucket crane.

High capacity and *flat-nose projectiles* and *shrapnel* are fragmented and ranged, as laid down in the specifications. Shrapnel is also tested in accordance with specifications similar to those of the army.

Target projectiles are ranged, three per lot, at service velocity.

Proof of Fuses and Tracers.—Detonating fuses of various types are tested in accordance with the instructions of the Bureau of Ordnance. All detonating fuses in shell filled with high explosive are fired in a covered butt to prevent the spread of fragments.

All *major, medium and minor caliber tracer* and *ignition fuses* have samples from each lot submitted for test.

The proof consists of several tests which ensure their safety and satisfactory functioning in service. These tests consist of:

1. Drop test.
2. Fragmentation test.
3. Flight test.
4. Plate tests.
5. Tracer test.

The drop test consists of dropping a blind loaded projectile, in which the fuse has been inserted, a distance of 30 feet or more. The fuse must not arm or the tracer, if fitted, ignite.

The fragmentation test is made by causing a fuse to act in a service projectile filled with service explosive.

For the flight test, a projectile loaded with black powder, with the fuse inserted, is fired down the range. The fuse must not act prematurely or in flight.

For plate test, several projectiles, loaded and fused as for service, are fired through plates three-sixteenths of an inch, or above, at service velocity, or below, as specified. The fuses must function satisfactorily in all cases.

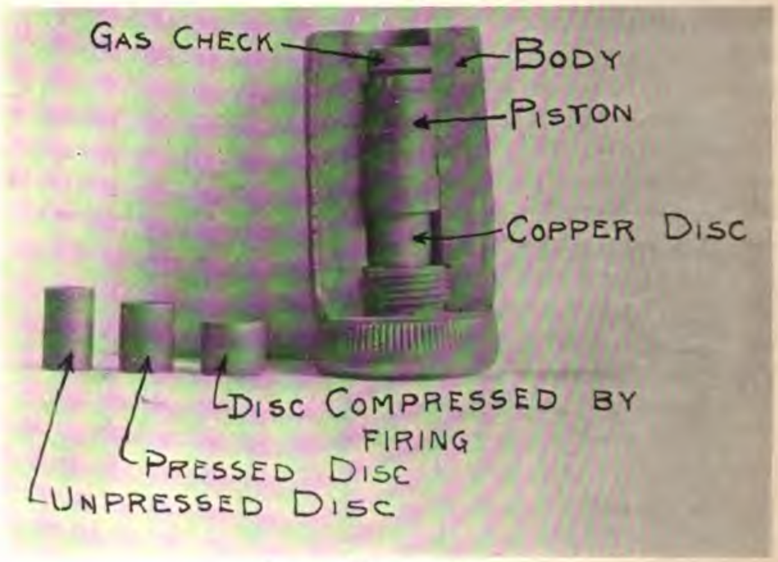


FIG. 5.—Pressure Gage.

For tracer test of fuses so fitted, three are fired in service projectiles at night, down the range. Two out of three must function satisfactorily so as to be followed by the eye for 12 seconds. Two or more timekeepers are used and the gun is served as rapidly as possible.

Time fuses are tested in shrapnel to determine time of functioning and variation from the mean time of burst. They are also given percussion tests at plank, canister test at 0 seconds setting and graze test on a pile of sand. In all cases they must function satisfactorily.

Special fuses are given special proofs, as laid down in the specifications under which they were manufactured.

Proof of Armor.—Armor is proved by determining its ability to withstand the attack of an enemy's projectiles at battle ranges, and the test simulates actual conditions as far as possible. A sample plate from each lot is selected by the inspector at the works of the manufacturer, who chooses the plate expected to give the poorest ballistic results. The sample plate is shipped by rail to the proving ground. Class "A" (face-hardened) plates are set by a large locomotive crane against heavy oak timber structures in front of sand butts. The plate is backed or unbacked in accordance with specifications and is secured to simulate service conditions.

The test is carried out in a similar manner to an armor-piercing shell test. The gun is usually of approximately the same caliber as the thickness of the plate. Velocity and pasteboard screens are used. The projectiles are those known to be of uniform quality. Tubes and plates are placed in front of the plate to prevent the scattering of fragments.

Several rounds are fired. After each, the plate is inspected to be sure that it has defeated the projectile in every respect, as laid down by the specifications. Measurements are taken and recorded, as in the case of shell tests. After the completion of the test, or sometimes after each round, the plate is stencilled with the striking velocities and photographed. (See Fig. 5.)

Plates passing successful test become the government's propterty and are available for test of armor-piercing projectiles. Failed plates are the manufacturer's property and are returned at his expense.

Class "B" plates (special treatment steel, such as turret and conning-tower tops) and protective deck plates are set for test so that the projectile strikes at an angle equal to the anticipated angle of fall of an enemy's shell. As it is impractical to strike a plate in a horizontal position because of the ricochet of the projectile, the plate is set vertically and the projectile caught in a sand butt behind. The plate must not fracture under the impact.

Full reports are made to the bureau of the ballistic results.

Proof of Explosives.—Explosives are tested by using samples of each lot to fragment service projectiles in an explosion chamber. Each sample must function in a satisfactory manner.

Proof of Cartridge Cases.—Cartridge cases are proved by firing sample cases three rounds each, thus ensuring satisfactory

another bunch. In the morning, the continent of America was gone, and soldiers and sailors alike strove to keep the startled look out of their eyes and to appear as if going to sea were an old story. Only one man, a mess attendant who not long ago had been cutting cane in the wilds of St. James Parish, was frankly and ostentatiously miserable. He crouched against the rail of the well-deck, and, between paroxysms of sickness and snatches of audible profanity, he busily read a small Bible. Six big troopships waddled along like plump old ladies, their foam-white petticoats close around thick ankles, and ahead sulked the cruiser convoy, like a mad small boy ordered to show the ladies the way to the post office. Youngsters in khaki were buttonholing youngsters in blue and asking many questions. The youngsters in blue, rather than admit that they had never been out over night before themselves, gallantly supplied artistic misinformation. Before night, a new phrase was born. A sergeant had asked him with puzzled face, "Who is that bird who goes around every two hours yelling 'Feed the whale and look out?'" Thereafter, the wheel of that ship was invariably relieved to shouts of "Feed the whale!" and at least one watch officer (Pelham Bay, ex-Bowdoin, 1919) was heard to gravely pass the word in those terms.

The reputation of the sea has suffered much through human haste. Not content to reach the other side, the average traveller would hurry, hurry, hurry—on the broad, open ocean there is no landmark, no point of departure visible by which one may note his rapid and satisfactory progress. Mrs. Fulano, of Chillicothe, is in haste to reach Paris. Atkins, Bull & Co., Ltd., of Liverpool, are clamoring for their cotton. And so the normal ship takes the great circle course across the broad Atlantic and rushes through day after day of gray skies, whistling gales and spiteful seas. The seagoing recollections of most travellers embrace only a port at each end of the run and a weary stretch of "The roaring forties" between.

Over There, the international firm of Foch, Haig, Diaz and Pershing were also clamoring for their freight, but they stipulated that the freight should arrive in good condition. Largely on that account, largely because of the unaccustomed hang of those blue overshirts which still carried faintly the whiff of block camphor, and largely because the chances of finding a

needle decrease geometrically with the size of the haystack used as wrapping, the east-bound transports let the North Atlantic gales roar themselves out unwitnessed and unwept. And there are few bits of seagoing more homely and kind to the neophyte than the long, lazy stretch between Cape Charles and the Rendezvous. Day followed day, a blaze of sapphire underfoot and turquoise overhead, the brilliant sunshine flooding the entire convoy and warming the stunned enthusiasm of the few unfortunates who found the throb of the screws and the smell of paint and tar disconcerting. On first reading their lookout stations bill (it had been snowing in Gravesend) the soldiers had looked fearfully at the foretop with resolute lips and unconsciously tightened fists. After three or four days, the watch in the crow's nest could usually be seen laboriously scrambling up to his station a good half hour ahead of time, while the watch relieved stayed to swap yarns for another half hour—unless a meal was being served below. A stranger catching a glimpse of any of us at almost any time would have looked around for a passing ship flaunting the President's flag, for we sailed with yards, rail, booms and rigging perpetually manned. Wherever was room to sit and swing one's feet, or even to hang solidly by one knee and one elbow, there for 10 hours a day sat or swung a soldier. A submarine west of the Azores would have been spotted at many times torpedo range. The well-decks and alleys were as packed as the alleys of a Chinese city; but just as a Chinese crowd can open out in mysterious fashion to let through a hurrying palanquin or a trotting coolie with his two swinging baskets, so would the swaying mass of brown flannel open and close behind a pair of perspiring messmen staggering along with a huge food-container or a working party on the run to secure a swinging boom. "Comin' through! Hot stuff!" cleared the gangway as effectually as a traffic squad.

Day followed day in exact routine replica, and it is hard to say who furnished most of the humorous flashes that made each day less monotonous; the soldiers, frankly "at sea," or the sailors to whom each day was a new and glorious draft of pure romance. There was discipline of a very complete sort, but like to no discipline hitherto witnessed by the world in arms. Conversation was the rule, and while orders were quickly obeyed and seldom questioned, they were always commented upon in a

least, believed that the radio compass would work and insisted that it should work.

One cannot but feel that the radio compass, as an aid to navigation, will develop into something of considerable value. Stations are now under construction in the vicinity of several important harbors along the Atlantic coasts. These should be of some service in bringing ships in which have been forced to make a long passage with no opportunity to check their dead reckoning, and, if properly operated, would, even in the event of a ship having been able to get plenty of sights, be an additional safeguard. The best mode of operation would seem to be to have these stations take simultaneous bearings when requested and transmit these bearings by land wire to a central radio transmitting station, equipped with a chart having a compass-rose at each radio compass station and a rule pivoted at each. Four compass stations for a port of the importance of New York or Boston would seem desirable. The central station could then almost instantly determine the ship's position and send it to her by radio. It has been suggested that each compass station be equipped with a transmitter, but this plan seems to have some objectionable features; namely, the cuts cannot be checked against each other by an experienced radioman who knows from experience their relative values. Each station will have to send its reading separately, thereby creating more radio interference. I believe it to be somewhat questionable if merchant skippers on small ships will very frequently go to the trouble of getting a fix, but would probably be delighted to use it if given them.

I think it may be confidently stated that even in the present state of the art, shore radio compass stations can be built, if sufficient care is taken, which will give cuts within $\frac{1}{2}°$ to a ship equipped with a 5-kilowatt transmitter at a distance of 400 miles.

In summary, it might be said that experience has led me to believe that the radio compass in its present state is a practical and valuable device and, if no results are obtained, it rests entirely with the personnel concerned, directly or indirectly.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ELECTRIC CHLORINE INDICATOR

By Lieut. Commander P. V. H. Weems, U. S. Navy

The navy standard water testing outfit has been indispensable, yet if an electric indicator could be sufficiently developed to do the work of the former, there would be considerable saving in: (a) Chemicals; and (b) the time necessary for making the tests. There are now on the market accurate and elaborate water testers, but none seem to be practical for use aboard ship.

To obtain accurate data for developing a suitable electric indicator for the chlorine in water, it was necessary to run several tests. These tests gave the most promising results, as shown in Figs. 2 and 3. The complete apparatus is shown in Fig. 1. In a glass tube, 1½ inches in diameter, were fitted terminals of ⅛-inch brass wire, 1 inch apart, and 8 inches long. Two 60-watt Mazda lights connected in parallel were used as the pilot lights in the actual tests, but one light of the proper size would be preferable.

Water containing varying amounts of chlorine was poured into the tube till the pilot lights showed a faint glow, then the height of the water in tube and the ammeter readings were taken. These readings were taken only as a check, for the amperage for each test was approximately .12 amperes. With the height of the water in the tube, or with what is the same thing, with the immersion of the terminals as the ordinates, and with the number of grains of chlorine per gallon as the abscissæ, a curve was plotted. Since the conductivity of water varies with different temperatures, tests were made with the water at different temperatures. These results are shown in Fig. 3. Curves were also plotted (Fig. 2) with the immersion of the terminals as ordinates and with the temperature of the water as abscissæ. Water containing different amounts of chlorine was tested, giving the different curves, as shown in Fig. 2. This curve gives

stops for three-quarters of an hour daily when the bugles wail, "All hands abandon ship!" and the naval boats'-crews, mustered and stationed in two minutes, stare incuriously at gang after gang of soldiers pouring up the ladder to the singsong of "Raft 56! No Absentees! Up that ladder out of the way, please!" Then the bugles sound "Secure" and "Retreat" and within five minutes it starts again, "thump, thump, thump!" At 3.30 the carpenter's gang appear from the compartment of shavings wherein they habitually lurk, and there is heard over the ship the slamming of airports and a hammering as the light-baffles are nailed over the doorways. The sun drops and in an instant the familiar outlines of the smallest compartments and narrowest passages disappear in almost tangible darkness. Here and there a faint blue glow far down the bulkhead makes a barely visible spot to point out the way. Junior staff officers foregather with the carpenter and dispute as to who has the middle watch, and from dark till dawn, through the dense blackness of the decks outside, one of them is continually wandering, looking for a tiny shred of visible light. This is part of the day's work that is taken very seriously. To the last private we know how far the coal of a cigarette may be seen under favorable circumstances. The writer was once told by a sentry: "You must either go in or take off that watch, sir. I can see the dial shining."

Everything is queerly changed in that blue light. At dinner the butter looks like tomato jelly and the pork chops take on an odd, unburied aspect. One peers closely to see whether his glass holds water, lemonade or cold tea. But so strong is human ability to adjust itself to circumstances that the men at first obliged to grope along with outstretched hands are soon playing cards and even reading by the blue lights. It is not difficult after learning to watch the shape and not the color of the cards, for black or red, they all look green.

At dinner in the mess room, a voice rings out of a dark corner over the clatter of groping forks and conversation. We know it is the chaplain, from the sprightly and insinuating way that he shouts, "MAY I have your attention one moment, please? To-night in this room at 8, Douglas Fairbanks in 'Soldiers of Fortune' and a Mack Sennett comedy. At 7, in Hatch No. 4, Mary Pickford in 'M'liss' and a Kay-Bee feature!" An army

officer at the next table is heard to say half to himself, "So *this* is the war zone!"

The talk over the coffee is as different from any former seagoing as the blue lights are different. Old regulars and ex-merchantmen, starting from common ground of Yangtse pilots or Cape Cod currents, are talking themselves into a new and genuine respect for each other. Youngsters from Pelham follow the swinging argument across the world from Rio Branco to Kennedy Road and keep a machine-gun fire of questions going.

Altogether, it is a very new world, and far removed from the docks a few days—or was it months?—in the past; a world where the souring of the yeast barrels is a hideous tragedy, the phonograph the greatest of man's inventions and the omission of one's compartment from the daily blacklist of the inspection report as great a triumph as being elected President.

It has frequently been stated with much heat by old-style militarists that there is no such thing as *esprit de corps* possible among untrained or partially trained new levies. We are proving every day that that is not so. The sailors carry around in their hearts as great a certainty that we are going to be torpedoed and as great a wonderment as to how they will behave themselves in emergency as any of the soldiers. But the soldiers have a right to worry. Their job is not a seagoing one—a man whose business is with shrapnel and bayonet may be excused for audibly dreading a deep-water bath and a long voyage under oars. With us it is different, and the honor of the navy is gallantly upheld in the fine air of amused toleration and caustic remarks of the bluejackets. "That water looks pretty darned cold," speculates a doughboy. "Hope we don't get a bath we ain't lookin' for." "At any rate," replies Jack, "it's clean water nobody ever used before. Not like the trench-water you'll sleep in all next year." On the other hand, there is fierce jealousy between the army units on board. At any small slip made by a national army man, the militiamen and regulars shake their heads. "Maybe you can get by with that in the national army," they croak, "but WE'D never stand for it." The reply is rather startling, for the national army man immediately comes back with, "Yah, draft evader!" The specialists make the most of their slightly different position. A big man with knotty hands is talking of the glories of his regiment of engineers. "No," he exults, "we

aren't conscripts. Neither are we militiamen," this with fine scorn. "We're all selected men for our jobs." A lean, deeply burned lad, whose bent legs obviously miss the cow-pony upon whose back he was brought up, takes this seriously: "I'm a militiaman," he drawls, "and you're selected right now, you son of a gun!" and his fist thumps on the big man's jaw. Every day the wisdom of the "Old Cattle Man" becomes apparent as concerns his statement of the different kinds of courage, that a man afraid of a gun may be cool and unruffled before a knife. There is one officer in France who wears on his tunic the valor cross, in recognition of the sheer cold-blooded daring he showed in assisting the wounded under fire. And yet that man, when he travelled with us, unsatisfied with the factor of safety furnished by a life-preserver, wore, all across the broad Atlantic, the inflated inner tube of a motor-cycle tire wrapped in a figure of eight around his body; and through the war zone not only never slept, but spent the night in the rigging, as high up as he could climb!

One morning we awake with a sense that something is different. There is a lazy swing to the ship and the engines dawdle along without their customary business-like pulsing. Suddenly the suspicion of a sound, hardly more than a sullen jar, quivers along the bulkheads. Again comes the sound, a little louder as the wind veers slightly. GUNS! Once out on deck we look around in bewilderment for the other ships of the convoy. There is our yoke-mate, though at an unusually great distance; but the others can only be located after sweeping the horizon—two far ahead, two far astern. As we stare, a flash leaps from the side of the distant cruiser and a smudge of white spray shows for an instant where the shell has struck. Astern of our mate something is troubling the water, something that rises and falls like the porpoises that have played around us since we passed Bermuda, but that sticks up like the back of no porpoise we have seen. The convoy is having target practice! We will soon be peppering that plunging spar that our sister ship is towing for our benefit.

Those of us in blue have been waiting for this day to show "Sister Susie" how much better off we are than she. She has 6-inch guns of which she has bragged, but they are old ones. Ours are only fives, but such fives as few ships can boast. Bran

new, and as we like to say, "The shootingest guns for their size ever made." The guns'-crews, transferred to us *en bloc* from a cruiser, all before-the-war veterans, swagger about the poop and forecastle, busily putting a final grooming on their already speckless pets. To the soldiers swarming over the rigging and the raft-nests it seems an interminable time before we begin; and never before has lookout duty been so popular. So many soldiers are claiming that it is their watch in the wing-stations of the fire-control platform that the control officers, range-finder and telephone gangs have to shoulder their way to their posts. But at last we are ready, and the stem swings around as the helmsman sings out his course monotonously. The whistle bellows and the red flag is broken out; and before the sound has died or the flag is fairly shaken out a forward gun cracks spitefully. The shell hits a little short, but to the unaccustomed eyes of the troops it has apparently buried that bobbing spar entirely and they cheer enthusiastically. The next is an over—a bad one. The third is very close, and thereafter shell after shell tears up the water so close that we wonder that no splinters fly. There is a moment's pause before the last shot and as it strikes, a solid log from the target-float flies up. The soldiers yell and pound each other's backs, and a signalman scrambles up to "Sister Susie's" platform and begins to semaphore. All over the ship bluejackets spell out his message aloud for the benefit of the crowding doughboys: "You—shoot—too—well. Why—destroy—my—target?" And the cheering breaks out afresh. Target practice is finished all too soon, and we romp out to get into formation again. But after that day the soldiers look less gloomily at the "pretty darned cold" water. They can now see visions of a conning-tower leaping into the sunshine as did that target raft. Not all the trumps are in Fritz's hand.

Imperceptibly we begin to tighten up. The sea gradually becomes less blue and turns to a troubled gray-green with white-caps here and there, and crashes away from under our forefoot in a way that suggests added speed. Someone figures out we must be nearing the Azores—that we are close to the barred zone. Bluejackets have less to say as they hurry by knots of questioning soldiers. The ship begins to pitch and twist a little. We are beginning to get the channel chop. One morning the order is passed that "beginning to-morrow, all hands will remain fully

dressed and will wear or carry their life-preservers at all times." This begins to look like business.

Through one night of rain-squalls and whistling gusts, the naval lookouts are peering through the dark with a new and vivid interest. All through the night little knots of passenger officers straggle around the decks, staring at the whitecaps that wink and disappear through the blackness, even those least accustomed to the sea feeling pleased that the waves are rising. It is uncomfortable, perhaps, but the higher the seas, the harder it will be for Fritz. The lookouts report many things that night, nothing they can definitely name, but a shape or disturbed water —something that looks alive. Then suddenly the faint flash of a blinker-tube snaps through the rain, then another and another. The destroyers are here! Those who are about the decks in the gray, dripping dawn see the cruiser that has led us across spin on her heel, shake a few more revolutions out of her impatient engines and head back along our trail—going home for another convoy. And as the light grows, one after another the flotilla appears, formless and indistinct in their wild war-paint, scrambling over the whipped wave-crests and sinking out of sight in the troughs, scurrying here and there around and ahead and astern of us like busy, questing terriers. Very tiny they look—incredibly tiny to be out in such a sea—but very self-assured and competent. In long swooping zigzags two search the sea far ahead. On both sides of the convoy others nose here and there, so that, however we are heading, there is always at least one destroyer between us and the swaying horizon. Astern, two more trot back and forth, back and forth, dancing like corks across our boiling wake. Our own engines are singing a new tune in a booming bass that makes the whole ship quiver. Our new-world feeling of isolation vanishes with a jerk. We are in the big world again, the real world. Just a little way over there is France, and we are now, *now* in the danger zone. Fritz may be watching our smoke from the horizon even now.

Very few even of those who ran the war zone regularly retain any cohesive recollections of it. Days and nights are merged in the memory into an interminable, yet somehow short, period of vibrant alertness, a steadily increasing tension. How many days and nights it lasted we know only from the ship's log. In retrospect it would seem something less than 24 hours that was

spent zigzagging among the careering destroyers, except that the recollection of the feel of our clothing is so vivid. The wettest and most exhausting duty could never in 24 hours cause wool, kapok and oilskin to grow so solidly to the skin, to become so unpleasantly an integral part of ourselves. We have bragged in the past of the soft weave of the knitted "socks from sister," but now every yarn and every stitch prints itself deep into the indignant skin. If we weren't so excited, so masculinely happy, we would be horribly miserable. This is the part of the game we were afraid would be too much for us—we have wondered how we would stand the gruelling discomfort. We find we can stand it very well, especially when we contemplate how much worse we'd feel if we were running the zone in one of those crazy, bedizened little cockboats of the escort. So we weary ourselves unduly through our fear of missing something. We watch the sea till our eyes ache with stinging spray or glaring sun. We stiffen to attention like a scenting hound when a lookout reports "Object in the water, sir!" and only partially relax with relief and disappointment when the destroyer who has dashed off to investigate finds only a floating spar or a patch of weed. When we sit down to eat, we find with amazement that we are very tired. When we lie down to sleep, we do so with ears strained; and when we finally drop into a dreamless, druglike coma, we are still straining our ears. The clang of a dropped slice-bar in the fireroom brings us instantly awake and abnormally sentient. And will any of us ever forget the time when the weary striker in the radio room, after being relieved, went to sleep where he sat and leaned against the button of the general alarm gong? That sudden and unexpected clamor caused a cold dinner for most of us, but we were all glad it happened, for as we found on checking up, the last soldier was at his abandon ship station in two minutes and a half. Snappy, I guess. No sign of a panic, either. Curiously enough, it is the wakeful nights that seem short, while the days drag interminably. Our eyes have learned an uncanny trick of seeing all around our heads, and what they see stands out with stereoscopic clarity and brilliance. There is so much and yet so absolutely nothing to see.

One morning the convoy splits in two, the three biggest ships veering away to the northward while we continue on our course. St. Nazaire it is—that point is settled. And we ought to be

there TO-MORROW. "Get by to-night, get by forever," remarks the boatswain, and then with instant mental association, "Do they have hot and cold water in French bathrooms?"

To-morrow comes, and with it the lee of the land. The wind has died with the sea, and so placid is the air and water that it seems that the coast must be visible. We breakfast, muster and clean house, and for once, it being the last day, those in authority dispense with spot-lights, and cease harassing compartment cleaners. By the end of the morning, most of us have finished our chores, and with life preservers unfastened are basking in the sun and watching for the land, eyes shining with anticipation from faces pallid with sleeplessness. We have "got by" the last night out and are beginning to relax just a little.

The siren of the ship to port screams insanely and a stern gun thrashes a shell into the water off her quarter. Bugles burst into a nasal chatter and all hands jump to battle stations. The line of soldiers on the booms begin to shout and point at a swirl in the water, as the destroyers leap like live things and race for the spot where the shell has fallen. Even in their sudden mad hurry, their cool-headed plan is shown, for while one jumps in full cry right at the trouble-spot, the others whisk a smoke screen across our stern. The leading destroyer whizzes on, then turns sharply, and as she turns, the tortured water cracks and roars with the burst of the depth bomb she has dropped. Back over the same ground she flies, and again looses a bomb, spinning on her heel to slam three quick shots into the smother of the explosion. Then head up and tail erect, she slips back into her place in formation, leaving a coal-burner that has apparently broken all records getting down off the horizon to sniff around questioningly at her leisure. An army officer who through the long voyage has had many tales to tell looks at his watch regretfully. "Just 11 minutes," he explodes, "and that fellow over there has had more fun than I ever had in my whole life!" At that moment, a long yell comes from aloft of "Land ho!" and we turn to see the gray shoulder of Belle Isle lifting above the horizon. Our cup of bliss is full. What does it matter to us that subsequent investigation seems to make of our submarine merely a floating spar and our naval battle just a little swank from the destroyer's skipper? To us, there is nothing more needed. We have had a brush with Fritz, we have seen his tin

fish rent to bits, and yonder in plain sight is FRANCE! That night the anchor rattles protestingly down into French mud and the ship is strangely still, for everybody, scrubbed to the blood, has climbed precipitately between the sheets and is fathoms deep in sleep.

Very strange and empty and enormous the ship felt on the way home, and in spite of the snarling gales of the northern route we took, it was a clean and shining transport that raised the coast of the United States. One could notice as the first liberty party swung up the docks to catch the subway for Manhattan that their overshirts *fit;* and in their faces was the calmness of men who have proved themselves. There was no more speculation and secret doubt. "Leave it to us," those faces seemed to say. "Bring on your doughboys as fast as you can make 'em. We'll put 'em across." And they did.

are taken, noting particularly: (1) Cracks in screw-box liner, plug or at muzzle; (2) condition of rifling; (3) crawling of tube or liner, at breech or muzzle; (4) length of recoil and counter recoil; (5) condition of case or gas check; (6) condition of primer; (7) blow-backs; (8) signs of failure of mount; (9) special notes, as directed by the bureau.

When predicting charges above service from the velocity and pressure curves, the proof officer must exercise great care when passing the critical point in density of loading, as pressures will jump excessively when this is reached. Cases have been known where the addition of one-tenth of a pound over the "near proof" charge in a medium caliber gun has caused a 10-ton increase in pressure; *i. e.,* from 18 to 28 tons. As the highest specified proof pressure is 20 tons, the gun was thus subjected to a pressure three-quarters in excess of service pressure. To the credit of the gun, it is noted that no signs of strain appeared, except that the firing lock was wrecked. Attention is especially called, however, to the fact that such an occurrence could not happen by the addition of a small amount to the *service* charge, as the critical point for powders issued to service is always safely higher than around the point of service charge and pressure.

Indicator cards showing the work done by the recoil liquid during recoil and counter recoil are taken with Tabor indicators, and are of much assistance to the gun factory in connection with design and determination of proper functioning. The action of the indicator is similar to one on the cylinder of a reciprocating engine, as the recoil is analogous to the piston stroke, and the recoil liquid pressure to steam pressure.

In special cases, the velocity of recoil may be taken by the chronoscope.

Various guns are given special proofs, *in accordance with the specifications,* which have been developed from the needs of the service. For example, all S. A. guns are fired 10 rounds rapid fire.

After proof, the gun is returned to the Naval Gun Factory, where it is bore-searched and star-gaged, and stamped with "P" and the initials of the inspector of ordnance in charge of the proving grounds.

Proof of Breech Mechanisms.—Breech mechanisms on proved guns are proved with three rounds—service, proof, service. Rapid-fire test of new S. A. breech mechanisms is in addition.

DISCUSSION

Increasing the Size of Battleships

(See Page 387, Whole No. 193)

Rear Admiral Seaton Schroeder, U. S. Navy, Retired.—The able paper by Captain E. J. King, U. S. Navy, on "The Effects of Increasing the Size of Battleships," in the March number of the Proceedings, commands a most interested attention. And conviction attends the reading of most of the statements and conclusions expressed.

On one point, however, there is, I think, room for discussion. That point is contained in the sentence, "Also the larger ships should be better gun-platforms, especially in heavy weather." The superiority of larger ships in that feature is dwelt upon throughout the paper, and it seems to be a generally accepted fact in professional discussions. The question in my mind is, "Are we sure that the statement is correct?" I must say that I am not sure; in fact, I incline to think that it is a mistaken notion as applied to ships to meet our particular needs.

As stated in the article, increase of size must largely be gained by increase of length and of beam, because any appreciable increase of draft is prohibited by the depth of water available, or likely to be available, in harbors and channels leading to our navy yards. Increased beam undoubtedly tends to increase stability, but it does so at the cost of steadiness; the two are antagonistic. The diminution of steadiness may be explained either by putting it that the deck of the broader ship follows more closely the surface of the waves, or by the more fundamental statement that the broader ship has a greater metacentric height. Even supposing, however, that by some inspiration the naval designer were able to shift his weights so as to appreciably raise the center of gravity and thus decrease the metacentric height, the result would still not be satisfactory, for the reason that winging the weights, either laterally or vertically, increases the roll after it is once started.

A condition is generally more convincing than a theory, and the first appeal on this subject was made to me by a condition. In the spring of 1906 a battleship, which I was to command later, was being swung for compass adjustment by the builders off the Capes of Virginia. I was surprised by observing a marked and disconcerting motion, while the sea seemed quite smooth; close attention then detected a long slight swell heaving. I spoke of it afterwards to the superintending naval constructor at Newport News, suggesting that the ship's behavior betrayed a considerable metacentric height, and I was told that the computations were not at hand, but that I was undoubtedly right and that it would probably prove to be something around 6 feet. This turned out to be about right, as well as I

1. The weight of charge to give service velocity.

2. The weight of charge to give target practice velocity, in the case of powders for which a reduced velocity is used.

3. The service pressure per square inch.

4. The target practice pressure per square inch.

5. The regularity of a number of rounds, as shown by the mean variation.

Powder is always proved at a uniform temperature of 90° F. (32° C.). This temperature is reached by gentle heating, done in air-tight tanks to avoid loss of volatiles. If the power is for a R. F. gun, the cases used in the proof are also heated to the same temperature. When made up, the charges are exactly as issued to service, as regards ignition, bags, mouth cups, primers, etc. The projectiles used must be of the type to be used in service with the proof powder. Each is carefully measured and weighed before being brought to the firing battery.

The proof of a powder consists of the development of a velocity curve and a pressure curve, in the same manner described under "Proof of Guns." The officer conducting the powder proof examines the "characteristics" of the powder as reported on the accompanying description sheet, *i. e.*,

(a) Web thickness,

(b) Volatiles,

(c) Nitration,

and with these as a guide, consults the velocity and pressure curves of a similar powder. As hundreds of these curves are on file, and allowed variations in powder manufacture are small, approximately the same characteristics can always be found.

If the web of the proof powder is smaller than the reference powder, the former will be quicker; that is, will require a smaller charge for the same velocity. This may be remembered by reducing to absurdity, as, for example, a one-pounder powder is quicker than a 14-inch. If the percentage of volatiles of the proof powder is lower than that of the reference powder, the former will be quicker; *reductio ad absurdum:* a dry powder grain will burn quicker than one soaked in water. If the nitration of the proof powder is higher than that of the reference powder, the former will be quicker. Aid to memory: gun cotton, which has a higher nitration than smokeless powder, is much quicker.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Change in Board of Control

Colonel Dion Williams, U. S. M. C. tendered his resignation as a member of the Board of Control upon being detached from duty in the United States and his resigna- ... with regret on April 8, 1919.

... membership, 5778.

... ons: 34.

... ar 1919 are now

... the U. S. Naval ... al dues until the

... he Secretary and ... to which PRO- *... ure their receipt.* ... ed to notify the ... f the non-receipt ... arted. The issue

... t will supply any ... retail price, post-

Departmen... ... d the purchaser through having ... supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary

and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

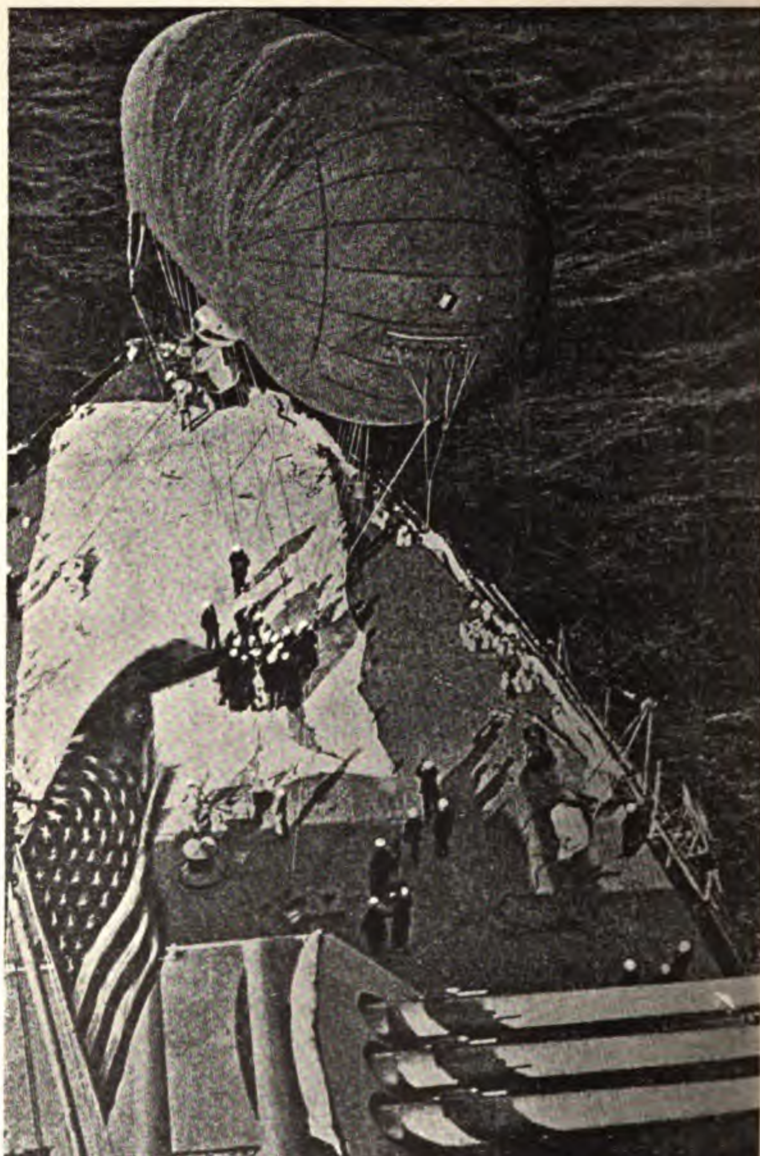
Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155, 166 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 50 cents per copy.

ANNAPOLIS, MD., APRIL 15, 1919.

INFORMATION INDEX



KITE BALLOON ON U. S. S. "OKLAHOMA."

The use of aerial observers with the fleet has become very pronounced during the war and fleet maneuvers.

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

GREAT BRITAIN

GRAND FLEET CHANGES.—With the dispersal of the Grand Fleet squadrons and flotillas from the northen bases it is expected that an alteration will be made in the grouping and designation of the Fleet. The title of "Grand Fleet," instituted for the war, will be dropped, and the forces in home waters will probably be known, as before August, 1914, as the "Home Fleet."

The battle-cruiser fleet as such will also disappear, the battle-cruisers forming one squadron with two divisions. Vice-Admiral Sir William Pakenham, commanding this fleet, with his flag in the *Lion*, was expected to be relieved at Davenport yesterday (Friday) by Vice-Admiral Sir Henry Oliver, who since March, 1918, had flown his flag in the *Kenown* in command of the light battle-cruiser squadron of the fleet.—*Army and Navy Gazette* 3/1.

TORPEDO BATTERY ON "REPULSE" AND "RENOWN."—A novelty is the adoption of the all-centerline position for the torpedo battery of eighteen 4-inch guns, which are mounted in three-gun shield mounts, open to the rear. Also the director-fire principle has been applied, all the guns being trained and elevated from a single fire-control station by the fire control officer.—*Scientific American*, 3/15.

PROPELLING MACHINERY—BRITISH "K" BOATS.—The main propelling machinery of the "K" boats consists of two sets of single reduction geared steam turbines and two boilers of the straight-tube three-drum type, having a working pressure of 235 lb. per square inch and arranged for burning oil fuel. Each set of turbines consists of one high-pressure and one-low-pressure cylinder, both turbines driving the main line of shafting by double helical gearing. An astern turbine is incorporated in each low-pressure turbine. The full power ahead shaft speed is 400 r. p. m., the corresponding turbine speeds being, high pressure 3500 and low pres-

sure 2800. The main motors, wehich are in the wings of the ship, somewhat above the shaft centers, are also connected to the propeller shafting by double helical gearing, the ratio in this case being two to one. The turbines can be declutched from the line of shafting when desired, while clutches are also fitted between the main motors and the shaft line. This latter set of clutches must be disengaged when the main shaft is running at above 220 r. p. m., and this unclutching is carried out by hand or automatically by governor gear. The turbines are installed in a separate compartment, watertight bulkheads being provided at the forward and after end of the compartment, with two doors in the former, one for access to the boiler room and the other to the main passage way to the forward part of the vessel; and one door in the aft bulkhead leading to the motor room.

The boiler room contains, in addition to the boilers, the feed pumps, oil-fuel pumps, heaters and filters, and forced-draft fans, the latter being driven by impulse steam turbines. A hinged funnel is provided for each boiler, arranged so that it may be lowered into the superstructure and the opening closed by a strong steel cover, both operations being performed simultaneously by means of an electric motor placed in and operated from the turbine room. In later boats a hydraulic semi-rotary engine is used. As a precaution against accident in the event of the funnel covers being damaged, an additional valve of special design is fitted on the hull of the vessel at the base of the funnel uptake. The covers for making watertight the air vents in the boiler rooms are hydraulically operated from the boiler room. In later boats of the class these covers are in duplicate. Arrangements are provided for shutting off the supply of oil fuel to the boilers before the funnel opening can be closed. The turbines, boilers and all hot surfaces are carefully and thoroughly lagged with incombustible, non-conducting material, with the object of reducing the temperatures in the engine room and boiler room to a minimum, and an efficient system of ventilation is provided throughout the machinery compartments.

For cruising, it is possible to use an eight-cylinder, 800 brake horsepower oil engine of the submarine type. This engine drives a dynamo which can be used for charging the batteries and for driving the ship at cruising speed by electrical transmission to the main motors. The auxiliaries for the oil engines are on the same lines as those fitted in ordinary submarine practice.

The auxiliary machinery in the ship is of the usual pattern for submarine service, though somewhat larger in cases. Two compressors are fitted for charging the 2500-lb. high-pressure air bottles, of which over 100 are fitted in the vessel. One of these compressors is motor driven and the other is direct driven from the end of the generator shaft. Two low-pressure air compressors are fitted for supplying air for blowing the water from the main ballast tanks when the vessel has broken surface. Two three-throw double-acting reciprocating bilge pumps, driven by electric motors, are also fitted for pumping the tanks and bilges. The telegraphs are of the ordinary mechanical type fitted with electric bell replies.

A special feature of these boats is the fitting of hydraulic power for various operations, such as working vent valves in the ballast tanks, air intakes in the boiler room, and the raising and lowering of the periscope rams and wireless masts. In the later boats this system is also applied to the funnel covers. The steering gear, and also the forward and after hydroplane diving gears, are operated by means of motor-driven Variable-Speed Gear Company's hydro-electric units, one for each service, controlled from pedestals placed in the control room. Hand gear is fitted in each case for emergency use. The steering gear itself is of the usual submarine screw-gear type.

needle decrease geometrically with the size of the haystack used as wrapping, the east-bound transports let the North Atlantic gales roar themselves out unwitnessed and unwept. And there are few bits of seagoing more homely and kind to the neophyte than the long, lazy stretch between Cape Charles and the Rendezvous. Day followed day, a blaze of sapphire underfoot and turquoise overhead, the brilliant sunshine flooding the entire convoy and warming the stunned enthusiasm of the few unfortunates who found the throb of the screws and the smell of paint and tar disconcerting. On first reading their lookout stations bill (it had been snowing in Gravesend) the soldiers had looked fearfully at the foretop with resolute lips and unconsciously tightened fists. After three or four days, the watch in the crow's nest could usually be seen laboriously scrambling up to his station a good half hour ahead of time, while the watch relieved stayed to swap yarns for another half hour—unless a meal was being served below. A stranger catching a glimpse of any of us at almost any time would have looked around for a passing ship flaunting the President's flag, for we sailed with yards, rail, booms and rigging perpetually manned. Wherever was room to sit and swing one's feet, or even to hang solidly by one knee and one elbow, there for 10 hours a day sat or swung a soldier. A submarine west of the Azores would have been spotted at many times torpedo range. The well-decks and alleys were as packed as the alleys of a Chinese city; but just as a Chinese crowd can open out in mysterious fashion to let through a hurrying palanquin or a trotting coolie with his two swinging baskets, so would the swaying mass of brown flannel open and close behind a pair of perspiring messmen staggering along with a huge food-container or a working party on the run to secure a swinging boom. "Comin' through! Hot stuff!" cleared the gangway as effectually as a traffic squad.

Day followed day in exact routine replica, and it is hard to say who furnished most of the humorous flashes that made each day less monotonous; the soldiers, frankly "at sea," or the sailors to whom each day was a new and glorious draft of pure romance. There was discipline of a very complete sort, but like to no discipline hitherto witnessed by the world in arms. Conversation was the rule, and while orders were quickly obeyed and seldom questioned, they were always commented upon in a

eliminated. Our own protective minefields must be lifted no less than the floating traps laid by the Germans. Mine-sweeping is an affair of vital national importance. If sufficient trained men volunteer for the new Mine Clearance Service, the fishing grounds and trade routes may be cleared by the autumn for traffic to move normally.—*London Army and Navy Gazette, 3/22.*

THE INTERNED GERMAN SHIPS.—The question of what is to be done with the German Fleet now interned at Scapa Flow is apparently still unsettled by the Peace Conference, which finds the problem no easy one to solve to the satisfaction of all the Powers interested in the fate of the ships. The American delegation, however, have put forward a memorandum explaining their views, from which it seems that the only difference between the American and British attitudes is that, whereas the country favors the destruction of the ships forthwith, the Americans advocate them being "sold as junk." Cogent arguments against the proposal to divide the vessels amongst the Allied Navies are set forth in the American memorandum. Such a distribution would increase the naval armament of the Powers by about 30 per cent; and this is rendered unnecessary by the removal of the German and Austrian menace. It is impossible to find a method of distribution which would be regarded as equitable by all, and as the German ships are of short steaming radius, built to fight near home, and are dependent upon German shops and yards for maintenance, they would be uneconomical and inefficient as part of any foreign navy, apart from the fact that they will soon be obsolete with the possible exception of the *Baden*.

As a compromise between the American idea of selling the ships as scrap iron and the British plan to sink them, there is a means of disposing of the hulls which would give a useful return to the Powers without raising awkward questions of inequitable division. This is to allow all the Allied Navies to use them as targets. Trials could be held at which the ships of all nations concerned, with guns of varying caliber and power, could be utilized.—*London Army and Navy Gazette, 3/29.*

GERMANY

THE FATE OF THE "DEUTSCHLAND."—The mystery which hitherto has surrounded the whereabouts of the merchant submarine, the *Deutschland*, has at last been cleared up. In June, 1917, the vessel was rammed by an English ship, in the Mediterranean.

Captain John Thompson of the British mercantile marine, who, for a long time, had been called "Deutschland Thompson" by his comrades, acknowledged the deed during a visit to New York. The British Admiralty gave him a reward of 1000 pounds (20,000 marks), and the D. S. O. (Distinguished Service Order) was conferred upon him by King George. when asked in New York for details, he answered: "I am the man that sank the *Deutschland*, but I may not talk about it." At that time the war was still in progress, but assuredly there were no grounds for this silence. Others, who knew the captain, and had been on voyages with him, have told more of his experiences.

In 1915, when Thompson was in command of a merchant ship, he was stopped by a German submarine in the Bay of Biscay. An officer came on board and questioned him concerning his cargo. The information given by Thompson failed to satisfy the U-boat officer, and he called the Englishman a liar. In English this word used in such a manner is considered a deadly insult. Thompson was furious, let fly at the German officer and knocked him down. When two German sailors had helped him to his feet, he drew his sword and wounded Thompson in the left hand the forefinger of which is still stiff.

In June, 1917, we learn Thompson went in another ship from Malta to Alexandria in Egypt. A large submarine, which appeared to be lying in wait, was sighted. The English vessel was unarmed and the only way of escaping the danger was to try to ram the U-boat. For more than an hour, the two ships circled around each other, mutually intent on gaining the advantage. The German submarine fired several shots, which did very little damage. Finally, the English ship managed to steer straight at the submarine and cut it in two. It was known that the former merchant submarine, the *Deutschland*, had been armed and was cruising in the Mediterranean, and from the unusual appearance and the size of the rammed submarine, Thompson decided that it must be the *Deutschland;* later, life-belts, etc., were picked up which, in fact, bore this name, so that there is little doubt as to the identity of the ship. In March, 1918, a vessel commanded by Thompson was torpedoed near the Azores, and Thompson was prisoner for some 40 days on board a German U-boat. Fortunately, says the English reporter, the Germans did not know that their prisoner was the man who had sunk their finest U-boat, with its crew of 100 men. Probably this Englishman imagined that it was this fact alone which saved him from being flayed alive—instead, as actually occurred, of his being set free, there being no room for prisoners on board our submarines.

Through these reports, the truth of which the gift of money to Thompson, and the fact of his being decorated, seem to confirm the rumors current in the press that the *Deutschland* had seen captured and was lying in an English port, were put an end to. It is characteristic of the English that they made no effort to save any of the one hundred men of the crew—only life-belts were picked up, not a man. When he himself was torpedoed, Thompson had the good fortune to have one of the "barbarous Huns" as an opponent, who sheltered him for 40 days.—*From German Press.*

AERONAUTICAL.—*Gothas for Great Britain.*—As soon as the circumstances permit, three of the German airplanes of each type surrendered under the terms of the armistice will be flown to England for exhibition purposes. The number of airplanes required from Germany is far from having been reached. In many cases the machines were found damaged or deficient in instruments or parts. On the British sector the proportion of large bombing planes—only about 20—left by the Germans is very small. The examination of all the planes surrendered has added to the accumulated evidence that in armament, fittings, and accessories of all kinds British aviation had completely outstripped the German air service. The total number of airplanes collected by the British Air Service is just over 500. About 170 were abandoned in open railway trucks and were left dismantled—a clear evasion of the armistice terms, and evidence of the hostile spirit in which Germany submits to the inevitable.—*Scientific American,* 3/29.

NAVAL TERMS.—The naval clauses of the Peace Treaty have been but very slightly amended, but it may be well to review them in slightly more detail than has yet been done.

All the clauses which relate to the fate of the warships to be surrendered by Germany are still subject to the reservation that the Allies have not yet come to an agreement whether or not the ships should be destroyed or broken up or used to make good Allied losses during the war. The object aimed at in settling the naval clauses was exactly the same as that which inspired the drafting of the military terms—namely, the reduction of the German naval strength to the requirements of police and frontier control. Perhaps the chief feature of the German fleet as it will be left after the stipulations of the treaty have been observed is that it will have no submarines.

The German fleet will consist of six battleships of the *Deutschland* or *Lothringen* type, six light cruisers, 12 destroyers, and 12 torpedo-boats in commission. All other warships, whose fate has not otherwise been

settled, must be placed out of commission or used for trade. In replacing units of the seagoing fleet it is laid down that vessels built shall not exceed 10,000 tons for armored ships, 6000 tons for light cruisers, 800 tons for destroyers, and 200 tons for torpedo-boats, and unless ships be lost no *Ersatz* battleship or cruiser can be built until the vessel it replaces is 20 years old, and, in the case of destroyers and torpedo-boats, 15 years from the date of launching.

The personnel of the German Navy, including land staff and officers, must not exceed 15,000, and there must not be more than 1500 officers and warrant officers.

All other German warships which are not in German ports cease to be German, and vessels interned are regarded as being finally given up, and warships under construction shall be broken up under the supervision of the Allies.

One clause, which, as already stated, is subject to reservation, provides that the following ships, with all guns aboard, shall be sunk:

Battleships.—*Oldenburg, Thuringen, Ostfriesland, Helgoland, Posen, Westfalen, Rheinland, Nassau.*

Light Cruisers.—*Stettin, Danzig, München, Lübeck, Strassburg, Augsburg, Kolberg, Stuttgart.*

Forty-two modern destroyers and 50 modern torpedo-boats.

All auxiliary cruisers are to be disarmed and treated as merchant ships. All submarines, submarine salvage vessels, submarine docks, including the Kiel tubular dock, will be handed over. Here, again, there is a reservation as to what shall be done with these craft. The material derived from the breaking up of the German warships must not be sold to foreign countries and can only be used for industrial purposes. Germany is forbidden to buy warships from abroad, or to buy or construct submarines even for commercial purposes. Naval war material, including such things as mines and torpedoes, will be fixed by the Allies, and all stocks in excess of those limits must be surrendered. Germany will be called upon to sweep certain areas free of mines.

The principle of voluntary service is also applied to the navy and petty officers, and men must serve a minimum period of 12 years. There is the same stipulation as to the length of service of officers as figures in the military terms. There is a provision forbidding the war training of officers and men of the mercantile marine.

In drafting the naval terms the necessity of obtaining free access for all nations to the Baltic has been borne in mind, and Germany will be called upon to demolish the fortifications commanding the passages to the Baltic and to place its hydrographical information with regard to the channels between the Baltic and the North Sea at the disposal of the Associated Government. The coastal defences and fortifications on German islands within 50 kilometers of the German coast will be treated as defences, and there is a stipulation that no fresh fortifications are to be constructed within these limits.

There is a provision prohibiting the use of wireless high-power stations for naval, military, and political messages without the consent of the Allied Governments.

The fate of the Kiel Canal has not yet been settled, nor has that of Germany's submarine cables.

With regard to Heligoland, the clause dealing with which is also subject to reservation, it has been pointed out that the destruction of the harbor and Heligoland might entail suffering to the fishing fleets which find refuge there in bad weather, and this question is still to be disposed of.—*London Times*, 3/20.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, MARCH 31, 1919

Type, number and name	Contractor	Per cent of completion			
		Apr. 1, 1919		Mar. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
42 Idaho	New York S. B. Co.	Del'd.3,	24/19	99.7	99.7
43 Tennessee	New York Navy Yard	68.4	64.4	64.2	58.2
44 California	Mare Island Navy Yard	57.2	45.9	55.6	42.8
45 Colorado	New York S. B. Co.	16.4	2.1	13.7	1.8
46 Maryland	Newport News S. B. & D. D. Co.	44.1	34.6	41.8	32.4
47 Washington	New York S. B. Co.	12.4	1.7	10.1	1.2
48 West Virginia	Newport News S. B. & D. D. Co.	20.5	2.2	19.1	2.2
49 South Dakota	Navy Yard, New York	0.	0.	0.	0.
50	Navy Yard, New York	0.	0.	0.	0.
51 Montana	Navy Yard, Mare Island	0.	0.	0.	0.
52 North Carolina	Navy Yard, Norfolk	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co.	....	....	0.	0.
2 Constellation	Newport News S. B. & D. D. Co.	....	....	0.	0.
3 Saratoga	New York S. B. Co.	....	....	0.	0.
4 Ranger	Newport S. B. & D. D. Co.	....	....	0.	0.
5 Constitution	Phila. Navy Yard	....	....	0.	0.
6	Phila. Navy Yard	....	....	0.	0.
Scout Cruisers					
4	Todd D. D. & Const. Co.	25.	1.6	24.5	1.15
5	Todd D. D. & Const. Co.	22.5	1.4	22.	1.
6	Todd D. D. & Const. Co.	18.2	.9	17.6	.6
7	Union Iron Works	0.	0.	0.	0.
8	Union Iron Works	0.	0.	0.	0.
9	Wm. Cramp & Sons Co.	9.	....	9.	0.
10	Wm. Cramp & Sons Co.	9.	....	9.	0.
11	Wm. Cramp & Sons Co.	0.	....	0.	....
12	Wm. Cramp & Sons Co.	0.	....	0.	....
13	Wm. Cramp & Sons Co.	0.	....	0.	....
Miscellaneous					
Fuel Ship No. 16 Brazos	Boston Navy Yard	91.	90.3	89.	88.
Fuel Ship No. 17	Boston Navy Yard	20.2	.5	17 8	.1
Fuel Ship No. 18	Boston Navy Yard	.2	.2	.1	.1
Gunboat No. 21 Asheville	Charleston Navy Yard	78.7	76.7	74.3	73.3
Gunboat No. 22	Charleston Navy Yard	0.	0.	0.	0.
Hospital Ship No. 1	Phila. Navy Yard	26.	12.5	25.	10.
Amn. Ship No. 1, Pyro.	Puget Sound Navy Yard	80.	72.	72.	62.
Amn. Ship No. 2, Nitro.	Puget Sound Navy Yard	32.	8.	18.	0.

There are 195 destroyers, 71 submarines, 20 mine sweepers, 19 sea-going tugs, 35 harbor tugs, 12 oil tankers and 53 Ford eagles in various stages of completion.

MATÉRIEL

NAVAL BUILDING PROGRAM.—In advance of the return to Washington of the Secretary of the Navy and the bureau chiefs who accompanied him on his European trip of observation, the naval general board is giving its attention to the new naval building program. The failure of the 65th Congress to enact a naval appropriation bill with its authority for the construction of new ships of course necessitates the reconsideration of the measure and its provision for new construction when the 66th Congress shall meet in extra session. By that time it will be known to what extent the proposed league of nations will impose a limitation upon armaments. It may be expected

as a certainty that Congress will be promptly, if not eagerly, responsive to any suggestion contained in the league of nations covenant permitting the suspension of the building of fighting ships. It becomes a question at once, therefore, whether Congress will authorize the construction of more than the six battle cruisers which were authorized in 1916, and upon which construction, with the exception of the machinery, was suspended during the war to permit progress on the destroyers. It has been anticipated by the naval authorities that Congress would consent to additions to this number in view of the unquestioned value of the type in modern warfare. Then, it must be decided whether the ten battleships included in the program in the bill of the last session shall be battleships of the dreadnought type or the advanced type which approaches the battle cruiser. It is bound to be the occasion of an interesting discussion before the naval committees where, as usual, there is destined to be a difference of opinion among members encouraged, perhaps, as too frequently occurs, by failure to agree upon types and other details of design among the naval experts themselves. That, indeed, has always been one of the handicaps in the matter of obtaining prompt congressional approval of any departmental plan for naval fleet expansion. Naval committee members have been quick to take advantage of this situation and to insist, by way of defence for their inaction or procrastination, that they can hardly be expected to reach conclusions upon highly technical questions when the naval authorities carry their controversies on the subject to the Capitol for ventilation. The enlightenment of committees, which might be argued in justification of this proceeding, has the opposite effect frequently of providing an excuse for doing nothing. —*Army and Navy Register*, 4/5.

A FLEET FOR THE PACIFIC.—There will probably be during the next year a Pacific, as well as an Atlantic fleet; certainly, there will be a division of the present naval force between the two oceans or a division of time of one big fleet between the Atlantic and the west coast. If there are two commands of considerable dimensions, respectively, there will be an exchange of visits periodically and a program of joint maneuvers at least annually. The people on the west coast have been insistent upon this and the sentiment and desire have been growing with the increase in the number of the fighting vessels. Of course, nothing has been said during the war, when it was realized that the available ships were necessarily employed in the war zone or held in readiness for assignment to duty abroad. Now, with the cessation of hostilities, the request from the west coast is likely to be renewed in stronger terms than ever, especially as there is apprehension in that quarter of the unfriendly, or at least suspicious, activities of the Japanese. In that connection it is interesting to learn that the State Department has formally announced its intention to thoroughly investigate the persistent rumors of Japanese acquisition of a naval base in Southern California through some sort of secret treaty with the Mexican Government. Significance is imparted to the incident largely from the unusual circumstance of the official admission of the purpose of the State Department, since, ordinarily, such an action would be conducted with as little publicity as possible. However, with or without a Japanese "war scare," that usually makes its appearance about the time the naval appropriation bill is reported from committee, there will be a determination to have a formidable and permanent representation of naval power on the west coast, while the presence of Senator Poindexter of Washington, as chairman of the Senate naval committee in the 66th Congress, will be a direct and positive contribution to that end. For the first time in many years the west coast will have an important "say" in the deliberations of a naval committee of Congress and, as in the old days, New England, and more recently, southern influence has affected legislation, so it may be expected that west coast influence will do something more than hitherto for the navy yards on the Pacific coast and toward having a fleet in that ocean.—*Army and Navy Register*, 4/5.

PERSONNEL

GAIN IN NAVAL ENLISTMENTS.—First enlistments in the navy showed a marked gain during February. Although the shortest month there was a total of over 7000 recruits for the naval service. Of these, 5812 were made in this country, mainly at recruiting stations, as compared with 5007 during January, a net gain of 715. Over 400 of the men shipped in February had seen creditable service in the army or marine corps. As we have stated in these columns a large majority of recruits are youngsters, over 68 per cent of the newcomers in February being under 19 years of age. In addition to the recruits obtained in this country, a large force of ex-soldiers comprising the Philippine army were enlisted in the messman branch at Manila. The first 1000 were enlisted in a few days, and an excellent start has been made on the second thousand of the quota assigned the station. These Filipinos have had military training that will make them a valuable adjunct to the navy, and their services are in demand in the messman ratings throughout the fleet. The steady demobilization of the naval reserve force necessitates the enlistment of a considerable force of regulars within the next few months to meet the absolute requirements of the navy afloat, and even with the satisfactory gains made during the past month the navy promises to have a serious problem on its hands to fully man all the vessels which will await crews during the coming summer.—*Army and Navy Register,* 3/22.

NAVAL PERSONNEL SITUATION.—The naval authorities have been discussing the naval personnel situation in anticipation of Secretary Daniels' return from Europe when it is expected that he will consider the subject in its relation to the departmental recommendations to the 66th Congress. One of the subjects to be taken up at the beginning of the extra session, which must be called before July first, will be the naval appropriation bill, which failed of enactment in the 65th Congress. That measure will, of course, contain a provision for naval personnel, and it is believed that Mr. Daniels will renew the recommendations he made at the last session without material modification or amendment. He will be supported by the present chief of the Bureau of Navigation, Rear Admiral Victor Blue, in the view that an enlisted strength of 137,000 will be sufficient to meet the needs of the navy, especially with the transfer to the shipping board of the vessels used in the homeward transportation of soldiers from Europe and the release of personnel employed in that service. There was a difference of opinion and some lively exchange of sentiment among the naval authorities and the Secretary of the Navy in regard to the enlisted strength when that subject was before the naval committee of the late Congress. It is expected that there will be greater unanimity hereafter and that Congress will not authorize a strength of more than the departmental program in this particular. Nor will there be any radical change in the plan for providing a commissioned personnel. The sentiment in Congress will not be in favor of making special arrangements to this end, beyond the authority to absorb into the regular establishment 700 temporary and reserve officers for the line with a proportionate number for the staff; 500 officers of the flying corps, of whom 250 will be kept on flying duty and 250 will be prepared for line duty; and 300 of the older warrant officers with provisions for their promotion up to the grade of lieutenant commander. Then Secretary Daniels will renew his recommendation for an extension of the principle of promotion by selection to all grades of line and staff of the navy and marine corps, upon which proposal action was not taken by the House naval committee at the last session. At that time it was felt that promotion by selection was sufficiently in vogue and that there was doubtful wisdom in extending it. Mr. Daniels, however, is firmly convinced that the system is meritorious and, if extended, will be productive of the best results in personnel efficiency. He also believes that the ensigns

at the end of the three-year period in that grade should be competitively examined for promotion to the grade of lieutenant, junior grade, leaving the latter grade the only one from which advancement to the next higher grade will be by seniority alone. There are, however, some objections to this proposed examination of the ensigns. It is pointed out, for one thing, that officers of this grade are apt, in many instances, not to have found themselves until later on in their career; on the other hand, it is insisted that the competitive examination will keep the ensigns keyed up to a standard of fitness which otherwise they may be prone to ignore. An additional objection, which is apt to have more influence, arises from the difficulty of conducting so many examinations as will be necessary in the course of a year in all parts of the world constituting an administrative situation that may be successfully urged against Mr. Daniels' plan in this particular.—*Army and Navy Register*, 4/5.

FIXING NUMBER OF NAVAL OFFICERS.—It need surprise no one in the navy or marine corps if a proposition is made in the naval committee of the next Congress to repeal existing law which provides for automatic increase in the number of commissioned officers of all grades and branches, and a return to the old method of maintaining a fixed number in each grade of line and staff, to be changed only by special authorization of Congress. There is objection expressed by some committee members to the system which bases the strength of commissioned personnel upon the number of enlisted men, despite what these critics admit is a plausible argument in its favor. It is evidently felt that advantage may be taken of this arrangement to create too many officers and to furnish special and extraordinary opportunities for adding to the number of commissioned officers. There is also a very well defined notion in the same quarter that the present sources of officers will be sufficient for the purpose of the service, considering the reserve personnel and the graduates of the Naval Academy. Indeed, there is a feeling that more should be done for the reservists in the way of promotion and in a provision for transfer to the permanent establishment. On the other hand, no such change is contemplated by the Navy Department and the proposition is not likely to receive the support of the Secretary of the Navy if he has an opportunity to pass upon it. It is certain to incur the opposition of the naval authorities, whose view in the matter is destined to have much weight with the conservative element in Congress.—*Army and Navy Register*, 4/5.

OPERATIONS.

SUBMARINE CHASERS ORDERED TO ALASKA FOR PATROL WORK.—Acting Secretary of the Navy Roosevelt authorizes the following:

Under the direction of the Navy Department a detachment of four submarine chasers has been ordered to Alaskan waters. The chasers will be accompanied by the gunboat *Vicksburg*, which will be the mother ship of the detachment, with two chasers operating at all times, two being held in reserve.

These vessels have been ordered to leave the navy yard, Puget Sound, about April 1, 1919, and to proceed to Juneau, Alaska, from which port they will operate until navigation closes.

Duty of Detachment.—This detachment will have on board fish wardens of the Department of Commerce, and have orders to cooperate with the officials of the Department of Commerce, the Treasury Department, and the Department of the Interior in enforcing law in Alaskan waters, rendering assistance to shipping and natives in distress.

The coast-guard cutters *Unalga* and *Bear*, operating under the direct orders of the commodore commandant, United States Coast Guard, pursuant to general instructions of the Navy Department, will also operate in Alaskan waters from about April 20 to October 1. The patrol by these coast-guard cutters is similar to that which has been maintained by the United States Coast Guard for several years past.—*Official Bulletin*, 3/24.

CAPTURED U-BOATS TO TOUR OUR PORTS.—Surrendered German submarines, now being brought to the United States by American naval crews, will be exhibited at ports on the Atlantic, Pacific and Gulf coasts, the Great Lakes and the Chesapeake Bay, and on the Mississippi and Hudson Rivers. The five submersibles will arrive at New York late this month, while the Victory Liberty Loan campaign is in progress.

The Navy Department announced to-day that after the fleet reached New York motion pictures would be made for display over the country, and that the submarines then would proceed on the following itineraries:

U-111, a submarine of the larger type, to Portland, Portsmouth, Boston, New Bedford, Newport, Providence, New Haven, and then lay up at New London.

U-117, a big ocean mine-layer, which planted mines on the Atlantic Coast during the war, will go to Philadelphia, Wilmington, Del., Wilmington, N. C., Norfolk, Baltimore, Annapolis, Charleston, S. C., and then lay up at Washington, D. C.

U B-88, a small type submarine, will proceed to Savannah, Jacksonville, Tampa, Pensacola, Mobile, New Orleans, thence up the Mississippi River to St. Louis, then to Galveston, Key West, through the Panama Canal, up the Puget Sound district, then lay up at San Pedro.

U B-148, a small type submarine, will be exhibited at various places in and about New York, then up the Hudson River as far as draft will safely permit, thence to Bridgeport and lay up at New London.

U C-97, a small mine-layer, will proceed from New York to Halifax, up the St. Lawrence River for exhibition at Great Lakes ports, and finally lay up at the Naval Training Station, Great Lakes.—*N. Y. Times*, 4/6.

MERCHANT MARINE

OFFICIAL PLAN FOR MERCHANT MARINE.*—The operation of a fleet representing 16,000,000 tons of ships, 70 per cent of which is owned by the government, is a problem that should be carefully considered from every angle, and in presenting this plan, I feel I should say that the government, without necessary delay, must take a prompt and definite step in giving legislative form to this, or some other policy which will meet with the approval of the country.

While the war was on, the recital of shipbuilding achievement found a quick and ready response from an enthusiastic public. There is less glamour and glory in the work of evolving a policy which will keep these ships under the American flag, and develop our commerce, but this work touches the life of the nation almost as closely as the emergency shipbuilding program.

I am personally opposed to government ownership, except as a last resort. During the war, it was necessary for the government to build a merchant fleet. Private capital never could have accomplished this colossal task, involving the creation of many new shipyards, and the training of a large army of workmen.

Government ownership of this large fleet resulted automatically. If we are to return to private ownership, the transition must be made under such conditions as will completely safeguard the interest of the public. If this fleet, built at government expense, were to be used now merely for the advantage of groups of ship-operators, with sufficient capital to purchase the ships from the government, I would unhesitatingly advocate the retention of the whole fleet by the government.

The problem is as complex as that of the railroad problem. Its solution is vital to the welfare and prosperity of the nation. Private ownership unquestionably offers an inducement to American energy and skill, but one

* From address delivered by Edward N. Hurley, Chairman U. S. Shipping Board, Thursday evening, March 27, 1919.

of the phases of unrestricted private control, which caused me considerable concern, was the possibility that under such control, ships would be overcapitalized as were many of the railroads. We want the initiative and skill of American ship-operators, but we want no watered stock. We want to avoid the stagnation that sometimes comes from red-tape and bureaucracy, but we want no profiteering nor exploiting.

We want the new fleet used for the benefit of the people of the United States and not against their larger interest. We want it used for the development of the nation's commerce, and not merely for the development of the private fortunes of ship-operators. No one will deny that our foreign trade, or the operation of American ships, will decline unless there is a profit for the men who invest their money, but whatever assistance the government is willing to render, should be reciprocated by those who are benefited. Therefore, the nation's shipping policy should certainly provide for such governmental representation as will guarantee a square deal to the public.

I think the whole nation is agreed that there must be no more scandals of overcapitalization in any part of American industrial or commercial life. The ships built by the nation should never be made the basis for any stock-jobbing scheme. The mere possession of large capital must not give the larger operator an opportunity to drive the smaller man out of business. In the plan I am ready to submit for the best thought and impartial discussion of the country, I believe you will find that the American theory of encouraging competition on fair terms is amply safeguarded.

In my judgment, any policy which does not encourage the building and the extensive operation of ships under the American flag will not satisfy the American people. I believe that a sound policy can be put into the form of legislation and that it will then form a permanent foundation for further improvements, as the need for them appears.

The United States Government now owns 555 ocean-going steel cargo ships aggregating 3,385,475 deadweight tons. In addition it has under contract 1336 similar vessels of 9,275,006 deadweight tons. If our present program be carried out, there will be under the American flag next year 16,732,700 deadweight tons of ocean-going steel cargo and passenger ships. This fleet will be the equivalent of almost half the merchant tonnage which plies the seas to-day under the flags of all nations combined. The government will own about 70 per cent of it.

The economic importance of this great fleet would be difficult to overestimate. Upon its successful operation under a sound financial and administrative plan by vigilant, courageous men who have the interest of American industry and commerce at heart, depends more than upon any other factor the future development of our overseas trade and of the domestic industries which feed it. With this brief review of the situation, I now submit this proposed plan of operation:

That the ships should be sold to and operated by American citizens under no restrictions other than the terms of the bill of sale and the fixation of maximum freight rates, either as provided in Section 18 of the Act approved September 7, 1916, or as may be agreed by the government and the operator in specific instances.

The ships should be sold at a price which fairly reflects the current world market for similar tonnage.

Twenty-five per cent of the purchase price of each ship should be paid down, the remainder falling due and payable in graded annual installments over a period not exceeding ten years. The government should take and hold a mortgage for the unpaid balance, charging interest thereon at the customary commercial rate of five per cent. One-fifth of this interest, representing the difference between the customary government interest of 4 per cent and the customary commercial rate, should be paid into a Merchant Marine Development Fund to be described hereafter.

The purchaser should be required to agree to insure and keep insured with an American marine insurance company, his equity in the vessel, and

because the American marine insurance market has not at present sufficient resources to underwrite all the vessels the government has to sell, the government should carry in its own fund, as at present, but for purchaser's account, hull and machinery insurance covering that part of the vessel for which payment has not been made. Our experience in operation shows that the government can carry this insurance for at least 1 per cent less than the open market rate. However, it is proposed that the open market rate be charged, and that the difference be paid into the Merchant Marine Development Fund.

It is understood that no transfer of a vessel to foreign registry should be permitted without express permission of the government.

Each purchaser who wishes to operate in the foreign trade should be obliged to incorporate under federal charter, the necessary legislation for which should be passed by Congress without delay. Such a charter should provide that no stock shall be issued in excess of the money value actually paid in on vessel property, and that no stock can be issued or transferred to an alien.

It should also provide that one member of the board of directors for each company shall be named by the government. This director should draw no salary, either from the steamship corporation or from the government. He should receive only the customary director's fee for each meeting he attends.

The same legislation should provide for periodical meetings of these government-named directors, in the city of Washington, where they will constitute an official body which will confer with and advise the Shipping Board, or other designated government agency, upon problems arising in, or questions affecting the welfare of, the American merchant marine, including the administration of the Merchant Marine Development Fund.

This fund drawn from the sources previously indicated, should be used to relieve such financial difficulties as may be encountered in the development of an adequate and well-balanced American merchant marine; for instance:

It is foreseen that a number of trade routes important to the immediate or future welfare of American commerce must be established and developed. Some of these routes may not yield steamship operating profits until their existence shall have attracted an increased volume or better balance of trade. Revenue derived from the carriage of mail, and possible fees for the training of seamen and cadet-officers, may partly compensate losses incurred on these routes. Still, in cases where the government sells a ship upon condition that it be operated in a route which may not prove profitable at once, it will be necessary to provide for the payment of defaulted interest from the Merchant Marine Development Fund, in the discretion of the Shipping Board or other government agency, upon recommendation of the board of government directors, until such time as the route may begin to yield profit. When the ships in the route earn their annual interest rate and a profit, one-half the profit earned each year should be paid into the Merchant Marine Development Fund until all moneys drawn from the fund on account of the vessel in question shall have been replaced. The other half should go annually to the steamship stockholders.

Such vessels cruising in routes which fail to prove susceptible of profitable development and which do not serve any purpose of the government of the United States, may be transferred by the government to other routes. However, should the government become convinced that any vessel has failed to make expenses solely or chiefly because of incapable management, it may foreclose its mortgage on that vessel.

On the basis of one billion dollars' worth of ships, the Merchant Marine Development Fund would be fifteen million dollars. This amount, investigation convinces me, would be more than sufficient to care for all deficiencies likely to develop during this period.

Until sold under the terms just stated, all vessels should remain the property of, and should be operated by, the government of the United States.

In order to make sure that the American merchant marine will be operated with due regard for the interests of American industry and commerce, it is necessary to exercise control over the maximum freight rates which may be charged in regular trade routes.

Sections 16 and 17 of the Act approved September 7, 1916, provide remedies for unjust discrimination by American shipowners against any American shipper or port, and they also forbid the collection by common carriers in foreign commerce of any rate unjustly prejudicial to American exporters as compared with foreign exporters. Section 18 of the same act authorizes the fixation of maximum freight rates charged by common carriers by water in interstate commerce.

There remains to be provided means for preventing the impartial imposition of unjustly high rates upon all commerce moving into or out of the United States. This is manifestly beyond the power of legislation at the moment, and it is proposed to secure such control by agreement inserted in the bill of sale under which the ships are released, and by making such control a condition of participating in the benefit of the Merchant Marine Development Fund.

THE NECESSARY RELATION BETWEEN THE MERCHANT MARINE AND THE NAVY.—During the war I have been brought into close contact with many officers formerly of the merchant marine, but who are now enrolled in the navy—I have learned much from them, and my association with them, and my inspections of the ships which they command have impressed me not only with the desirability of a common plane upon which the navy and the merchant marine can work, but also of its practicability. Indeed, I regard it as essential to the efficiency and permanency of the merchant marine.

The year 1917 was, so far as our merchant marine is concerned, *annus mirabilis*. Then it was we commandeered about 400 foreign vessels building in our shipyards, and ordered a total of 2000 vessels to be rushed to completion; it did not need any high-brow demonstration to show that this country required ships, plenty of them, and just as quickly as we could get them. We were going to send an army of 2,000,000 soldiers beyond the seas, and every man required five tons of shipping. This was the rebirth of our merchant marine.

And now the problem is how to assure the healthy development of this infant. It would appear neither wise nor expedient to attempt to place our new merchant marine exclusively either under the government or under private control. For the time being at least, a combination of these controls would appear necessary. In framing a policy we must watch closely the methods of foreign governments. It is manifest that our shipping industry must be backed by our government and that our navigation laws must be changed to the extent necessary to assure competition with foreign shipping on a basis of parity. At the same time, in order to hasten the stabilization of trade conditions private enterprise should be encouraged to enter the shipping business at once, and as things settle down to take over step by step a larger share of the management.

We must adopt the point of view that a large and sufficient merchant marine is an absolute necessity for our national prosperity and possibly for our national existence.

I would suggest as a connecting link between the merchant marine and the navy it might be well to retain a few lines of fast mail steamers manned by a regularly enlisted auxiliary naval personnel. These steamers to be so constructed and their crews so drilled that in an emergency they would be immediately available for war service as scout cruisers. Whatever the details of policy finally decided upon, in any event, it is certain that the

navy and the merchant marine must remain closely related. The experience of the war has driven home the essential value of a prosperous merchant marine as a national naval reserve.—*From Address by Vice-Admiral Gleaves, 3/27.*

AMERICA RAPIDLY REGAINING HER PLACE AS LEADER OF WORLD'S MERCHANT MARINE.—The Shipping Board issues the following:

At the opening of the European war the very little seagoing tonnage operating under the American flag carried only 9.7 per cent of the exports and imports of this country. To-day the American merchant marine comprises 46 per cent of shipping plying between our own and foreign ports. Moreover, this new and rapidly increasing fleet now represents nearly one-fifth of the entire seagoing tonnage of the world.

Although a very large number of our ships are still absorbed by army and navy needs, there being on January 31 a total of 302 vessels diverted to army requirements and 51 to the navy, yet we had enough shipping left to make an important showing in overseas commerce. Tables prepared by the Shipping Board's Division of Planning and Statistics show that on January 31 there were employed in overseas service under the American flag a total of 752 vessels, aggregating 1,961,239 gross tons.

This fleet includes 351 freighters, 84 freight and passenger vessels, three freight and refrigerator vessels, seven freight, passenger, and refrigerator ships, six colliers, 71 steam tankers, and 230 sailing vessels.

When the army and navy return to the Shipping Board the 353 ships which they are now operating, the commercial fleet under the American flag will be augmented by 1,873,521 gross tons, equivalent to 2,434,017 dead-weight tons.—*Official Bulletin*, 3/11.

NAVIGATION AND RADIO

THE WIRELESS COMPASS.—A coil of wire, a dial registering 360 degrees, a hollow steel shaft, and an automobile steering wheel have overcome the terrors of fog and storm to mariners approaching port. These few pieces of apparatus comprise the essential parts of the radio compass, an instrument whereby the bearing of any ship on a shore station may be ascertained with speed and accuracy.

In construction, the radio compass differs from the usual radio receiving set mainly in the type of antennæ used. The familiar sight of several strands of wire stretched at considerable length between high masts is absent. In place of the stationary, space-consuming aerial, is a rotating 5-foot frame with a few turns of stranded copper-bronze wire wound about it. The frame is mounted on a vertical steel shaft which projects downward through the roof of the radio building into the room where the operator is on watch. In many stations, a cupola has been built about the frame with the double purpose of affording protection against the elements and of concealing its presence. At the base of the shaft, and within easy reach of the operator, the wheel which controls the turning of the frame is attached. The compass dial, usually a circular aluminum band, with the 360 degrees of the compass clearly engraved on its surface, is fastened to the shaft near the roof of the radio "shack"; but the indicator is placed in a permanent north and south direction. Two "leads" from the frame form the electrical path between the antennæ and the receiving set.

In conjunction with the receiver, an oscillating audion and an amplifier are usually employed thereby magnifying the strength of incoming signals about eight times their normal degree of audibility.

The theory on which this unique construction of the radio compass operates involves several characteristics of the electro-magnetic wave. If a pure sine wave (which is never met with in practice because of the distorting influence of objects in and around the radio room), is assumed, three phenomena of electricity combine to give the results observed in the radio compass. They are the resisting or "bucking" action of induced

currents, and the differences in amplitude and in phase of an electro-magnetic wave at different intervals of time. Two electric currents are induced in the antenna, the one when the magnetic wave comes in contact with the nearer side of the arial, the other when it reaches the farther side. These induced currents will be in the same direction, and consequently will tend to "buck" or counteract each other. But, due to the differences in amplitude and in phase of the magnetic wave at the two points of contact, the induced currents will be of different strengths; and, although the one tends to obliterate the other, the difference in strength between them is conserved and heard in the telephones. However, if an incoming electro-magnetic wave strikes the plane of the antenna perpendicularly, the currents induced in both sides of the compass will be equal in strength, of the same phase and amplitude, and will neutralize each other. No sound is then heard in the telephones. By means of the rotating antennæ, the angle at which an electro-magnetic wave acts on it can be controlled by the operator. Thus the intensity of an oncoming signal can be increased, diminished or completely tuned out by a turn of the wheel. It is evident, then, that when the plane of the antennæ is parallel to the direction of the oncoming wave, the sound heard in the phones will represent the maximum strength of the oncoming wave. By turning the antennæ until this point is found, the maximum strength of any signal can be ascertained; and consequently, the position of the ship or shore station sending it will be disclosed. But to be more accurate, two positions are made known, 180 degrees apart. By consulting the diagram, the reason for this is apparent. It will be observed that two waves coming from opposite directions will affect the radio compass in the same manner.

In actual practice, however, a shore station operator knows that the coast line limits the arc of the compass in which he may expect to locate a ship. Moreover, to secure the best possible results in the every-day operation of the radio compass in guiding vessels into the port of New York, five radio compass stations have been established at strategic nautical points on the coast near New York. Each station is connected by a land line telegraph instrument with a central controlling radio station located in the office of the District Communication Superintendent, at 44 Whitehall St.

The close connection between the compass stations and the control station simplifies the details of communication with vessels at sea. Within a few minutes a ship may receive definite information as to its position. When a ship approaches the 50 or 100-mile coast line, the operator abroad calls New York and asks for his bearing. The ship does not get into direct communication with the various compass stations as they are equipped only with receiving sets, and so cannot reply. However, the radio operator at the central controlling station, in answering the ship's call, transmits a signal to the ship to send its call letters for 30 seconds. At the same time, a telegraph operator at the control station notifies the various compass stations, by means of a three letter signal sent simultaneously, to obtain a bearing on the ship sending her call letters. Immediately the various stations in the district, at Montauk Point, L. I., Fire Island, L. I., Rockaway Beach, L. I., Sandy Hook, N. J., and Mantoloking, N. J., turn their compass wheels until an accurate bearing is obtained at each station. This is transmitted to the telegraph operator at the control station, who waits until all stations have sent their bearings before turning them over to the radio operator. The latter, when all the compass stations have been heard from, flashes by radio the bearing, in degrees, of the ship on the different shore stations. An acknowledgment from the ship of the receipt of the desired information completes the operation.

The accuracy of the bearing reported by each compass station is determined at the control station by consulting a map of the coast which is arranged with an ingenious device for the particular purpose it serves. The map, spread out on a large table, is covered with glass. Holes are punctured through the glass at the center of the large circles drawn about the various

compass stations as centers. The circumferences of the circles are divided into degrees. Threads are then led through the holes and laid out on the map. When a compass station sends a bearing to the control station, the operator there draws out a thread to mark the line of direction between the ship and the compass station. As the other bearings are reported, similar marks are laid down; and the point where all the threads intersect is the exact position of the vessel desiring to know its position. Sometimes all the bearings reported do not intersect when diagrammed on the map with black thread. Then the space enclosed by the various intersecting points designates the area in which the ship may be located.

In the immediate future every American port will be safeguarded by a system of radio compasses and control stations. Then, at any point along the coast, mariners will be enabled to check up bearings obtained in the old way, and need never fear missing the channel on a foggy night or in a rough sea.

From an article by Jerome Lachenbruch, Radio Electrician, U. S. N. R. F. —*Scientific American*, 3/22.

NAVIGATION AND RADIO

The wireless telephone messages between New Brunswick, N. J., and the steamship *George Washington* at Brest, France, covered a distance of approximately 3200 miles, the greatest distance yet covered by the wireless telephone by several hundred miles, B. F. W. Alexanderson stated to-day. He began experimenting for the General Electric Company at New Brunswick about two years ago, but before much progress could be made the government took over the plant for wireless telegraph communication with France. When the President decided to go abroad the experiments were resumed and the apparatus brought to its present state.

Mr. Alexanderson believes that commercial wireless telephone service will soon be established between all the principal cities of the world. The features of his invention making long-distance telephoning possible are, according to Mr. Alexanderson, his high frequency alternator, known as the Alexanderson alternator, which provides a more efficient way of generating electric waves, and his new magnetic amplifier, which transforms telephone currents to high-power electric waves. He also has a new antenna which is several times more efficient that any previously used.—*N. Y. Times*, 3/21.

RADIO TELEPHONY.—*First Field Trials of Radio Telephony*.—In 1914 it was decided that the apparatus and methods developed in the laboratory were sufficiently promising to warrant an attempt at transatlantic telephony.

In order that a practical demonstration of the method might be obtained an experimental station was constructed at Montauk, L. I., and a receiving station was constructed on the roof of the Dupont Building, in Wilmington, Del. A trial was made on April 4, 1915, in the presence of Professor Millikan and Colonel Reber, as well as Messrs. Carty, Gherardi, Jewett and others of the executives of the engineering departments of the American Telephone and Telegraph and the Western Electric Companies. The transmission was, of course, one way only. These gentlemen, therefore, witnessed the operation of the transmitting equipment at Montauk on one day and then on the following day visited the receiving station at Wilmington and listened to the incoming transmission. Wire connections between Montauk and Wilmington permitted the listeners at Wilmington to report immediately what words they had heard, or, as on the second day, it permitted the speaker at Montauk to report what he had said. The wire connection thus admitted of the verification of the experiment.

Following this demonstration the range was extended from Montauk to St. Simons Island off the coast of Georgia where a receiving antenna had been erected. For the purpose of this experiment the radio receiving circuit

at St. Simons was connected to a telephone circuit leading to New York. Similarly, the radio transmitting equipment at Montauk was connected to a telephone line leading from New York. The speaker at New York talked over a wire circuit to Montauk, by wireless to St. Simons and then by wire to a listener in New York.

The method which was used in transmission was essentially that which was followed in later experiments when the navy station at Arlington was used as a transmitting station. Prior to this time the inability of inventors to modulate large amounts of power in such a manner that the modulated current, when detected at the receiving station, could be obtained essentially free from distortion, had proven a serious limitation on the increase of range of transmission. It had been shown, however, that this limitation could be overcome by the use of the audion amplifier and modulator. The general method proposed, therefore, and the method finally developed was as follows: A small current of high-frequency was to be generated by means of a vacuum tube oscillator. This high-frequency current was to be modulated, essentially completely, by the voice current from the telephone transmitter. The resulting modulated current was to be amplified, or successively amplified, by distortionless amplifiers, of the vacuum tube type, until the energy which it represented was sufficient for transmission from an antenna over the desired distance.

For the production of a sustained high-frequency current a vacuum tube was used. With such a tube, provided its input and output circuits are coupled together and one of them contains a tuned circuit, the operation is one of successively amplifying its own output. This successive amplification will result after a moment in the development of a steady state of oscillation in which there is a definite maximum of output current. This maximum amplitude of the generated alternating current depends for its value upon the characteristics of the tube itself.

As noted above, the study of the vacuum tube had also indicated that although it was possible to use the tube as a distortionless amplifier, it was also possible to adjust its voltages and the impedances to which it was connected so as to produce a distortion of the input current in a manner suitable for the purposes of radio telephony. Under such conditions the output of the tube contains a component which is proportional to the product of such voltages as may be simultaneously impressed upon its input or grid-filament circuit. If one of these inputs is obtained from the oscillation generator just described and the other from a telephone transmitter, it is then possible to obtain an output which varies harmonically with the frequency of the oscillation generator, and also varies harmonically in amplitude with the frequency of the voice current impressed by the transmitter.

A vacuum tube, properly designed for the impedances between which it was to be connected and properly adjusted so as to emphasize the modulator characteristics, was used as a modulator in the system of transmission which was formally demonstrated at Montauk. To its input was coupled inductively the tuned circuit of the oscillation generator and also telephone transmitter circuit containing a local battery.

In order to obtain a sufficient amount of energy for transmission over appreciable distances, it is necessary to amplify the energy output of the modulator before impressing it upon the antenna. In case considerable amplification is desired it may be obtained by impressing the voltage from the modulator upon an amplifying system formed by two amplifiers in tandem. It was also realized that amplifiers might be worked in parallel, that is, with their input circuits connected in parallel and with their output circuits connected in parallel, without introducing disturbing interactions, provided that certain precautions are taken. The method of amplification adopted for the Montauk tests and later used for the Arlington experiment was therefore a system of two stages of the amplification. At Montauk the first stage was obtained by a single tube and the second stage by a number of tubes in parallel.

The Arlington-Darien Experiment.—The tests from Montauk to Wilmington and to St. Simons Island were so successful that it appeared practicable to carry the method to its logical conclusion and to extend the range of radio telephony to much greater distances. For this purpose experiments were undertaken in conjunction with the Navy Department. For the initial steps in making such arrangements and for assistance throughout the experiments, we are indebted and distinctly grateful to Admiral R. S. Griffin, Engineer in Chief, U. S. Navy, Captain now Admiral W. H. G. Bullard, Superintendent of the Radio Service, and to Commander now Captain Hepburn and Lieutenant now Commander C. S. Hooper of the Bureau of Steam Engineering, U. S. Navy.

For the purpose of these experiments a small operating house was constructed beside the main operating building of the Navy Wireless Station at Arlington, Va. An antenna switch was provided so that the antenna might be connected to the Western Electric equipment in this experimental station. Captain Bullard also arranged for observers from the Western Electric Company to be present at the navy stations at Darien, San Diego and Mare Island. The necessary apparatus was installed in the early summer of 1915 and preliminary experiments were started at once. On August 27 successful transmission was obtained to Darien on the Isthmus and was received by Mr. R. H. Wilson of the Western Electric Company and by Lieutenant R. S. Crenshaw of the navy.

On this day Colonel Reber, Lieutenant Bryant of Captain Bullard's office and Mr. G. H. Clark, radio expert of the Bureau of Steam Engineering, had been asked to speak from Arlington in the hope that communication would be established with Darien. Immediately prior to the time these gentlemen spoke, two selections were played on a phonograph placed in front of the telephone transmitter. These were correctly recognized by Wilson and Lieutenant Crenshaw. Each of the visitors then spoke for a minute or two. The voices of the speakers were not familiar to the observers at Darien. Wilson, however, recognized the change in voice caused by a change in speaker and received correctly several phrases and some scattered words. These words were also verified by Lieutenant Crenshaw. A report of these results was sent immediately from Darien by navy code to Arlington and was compared by the speakers with their records of their spoken words.

The method of transmission was essentially that described above in connection with the Montauk experiment. The transmitters used in these tests were of the ordinary commercial type, or of a type which was then in a stage of development and which it was thought might reproduce more exactly some of the higher harmonies of the voice. A phonograph was also used for the transmission of music. The output of the transmitter was amplified in a speech amplifier of the audion type. The output of this speech amplifier and of the high-frequency oscillator were both impressed upon a modulator of the vacuum tube type. The voltage of this amplifier was not, however, high enough for the main amplifying tubes, and it was stepped up by an intermediate group of amplifiers, of which six as a rule were used. The modulator output thus amplified was impressed upon a number of power tubes in parallel and then upon the antenna transformer. The amplifier tubes preceding the power tube and the modulator were also of the same form, but were of different constants, properly adapted to their purposes.

The current by which the filaments were heated was supplied by a local power company and brought in by underground cable to the operating station. Alternating current was used for heating the filament and any possibility of the superposition of a 60 or 120 cycle note, due to the frequency of this current, was eliminated by the use of a special scheme of connections. Between the plate and the filament of the power tube a constant voltage of about 500 volts was impressed. It was obtained from one of the motor generators used by the navy in operating the large Poulsen

sure 2800. The main motors, wehich are in the wings of the ship, somewhat above the shaft centers, are also connected to the propeller shafting by double helical gearing, the ratio in this case being two to one. The turbines can be declutched from the line of shafting when desired, while clutches are also fitted between the main motors and the shaft line. This latter set of clutches must be disengaged when the main shaft is running at above 220 r. p. m., and this unclutching is carried out by hand or automatically by governor gear. The turbines are installed in a separate compartment, watertight bulkheads being provided at the forward and after end of the compartment, with two doors in the former, one for access to the boiler room and the other to the main passage way to the forward part of the vessel; and one door in the aft bulkhead leading to the motor room.

The boiler room contains, in addition to the boilers, the feed pumps, oil-fuel pumps, heaters and filters, and forced-draft fans, the latter being driven by impulse steam turbines. A hinged funnel is provided for each boiler, arranged so that it may be lowered into the superstructure and the opening closed by a strong steel cover, both operations being performed simultaneously by means of an electric motor placed in and operated from the turbine room. In later boats a hydraulic semi-rotary engine is used. As a precaution against accident in the event of the funnel covers being damaged, an additional valve of special design is fitted on the hull of the vessel at the base of the funnel uptake. The covers for making watertight the air vents in the boiler rooms are hydraulically operated from the boiler room. In later boats of the class these covers are in duplicate. Arrangements are provided for shutting off the supply of oil fuel to the boilers before the funnel opening can be closed. The turbines, boilers and all hot surfaces are carefully and thoroughly lagged with incombustible, non-conducting material, with the object of reducing the temperatures in the engine room and boiler room to a minimum, and an efficient system of ventilation is provided throughout the machinery compartments.

For cruising, it is possible to use an eight-cylinder, 800 brake horsepower oil engine of the submarine type. This engine drives a dynamo which can be used for charging the batteries and for driving the ship at cruising speed by electrical transmission to the main motors. The auxiliaries for the oil engines are on the same lines as those fitted in ordinary submarine practice.

The auxiliary machinery in the ship is of the usual pattern for submarine service, though somewhat larger in cases. Two compressors are fitted for charging the 2500-lb. high-pressure air bottles, of which over 100 are fitted in the vessel. One of these compressors is motor driven and the other is direct driven from the end of the generator shaft. Two low-pressure air compressors are fitted for supplying air for blowing the water from the main ballast tanks when the vessel has broken surface. Two three-throw double-acting reciprocating bilge pumps, driven by electric motors, are also fitted for pumping the tanks and bilges. The telegraphs are of the ordinary mechanical type fitted with electric bell replies.

A special feature of these boats is the fitting of hydraulic power for various operations, such as working vent valves in the ballast tanks, air intakes in the boiler room, and the raising and lowering of the periscope rams and wireless masts. In the later boats this system is also applied to the funnel covers. The steering gear, and also the forward and after hydroplane diving gears, are operated by means of motor-driven Variable-Speed Gear Company's hydro-electric units, one for each service, controlled from pedestals placed in the control room. Hand gear is fitted in each case for emergency use. The steering gear itself is of the usual submarine screw-gear type.

Lieutenant Bastedo, Commander Bryant, and members of the telephone system. Messrs. T. N. Vail, U. N. Bethel, J. I. Waterbury, Bancroft Gherardi, and H. P. Charlesworth all conversed with Mr. Carty through the ether.

The Arlington-Honolulu Experiment.—Having successfully transmitted over water to Darien, a distance of 2100 miles and over land to Mare Island, a distance of 2500 miles, attention was now directed towards reaching the remoter points of Honolulu and Paris. Schedules were therefore arranged for experiments with these stations. With Paris, however, the arrangements as to schedules were necessarily delayed because of the difficulties in cable transmission occasioned by the war.

With Honolulu, on the other hand, arrangements for a transmitting schedule had been made shortly before the demonstration of the New York-Arlington-Mare Island transmission. The first deliberate attempt to communicate with this station occurred on the night following the demonstration to Mare Island. Mr. Lloyd Espenschied of the American Telephone and Telegraph Company, who was the experimenter at this point, reported by cable the following morning, giving a record of the words which he had heard spoken, and also the name of the speaker, whose voice he had recognized.

The Arlington-Paris Experiment.—At Paris where Mr. Shreeve and Mr. Curtis of the Western Electric Company, in which connection it may be mentioned that they are again in France, the former as lieutenant colonel and the latter as lieutenant in the signal corps. These experimenters had installed their apparatus in the Eiffel Tower station of the French Army. This courtesy had been accorded our representatives by Lieutenant Colonel Ferrié, Director of the Military System of Radio Telegraphy, to whom they had been introduced by Commander W. R. Sayles, Naval Attaché of the American Embassy. The magnificent spirit which France has shown throughout this bitter struggle is well illustrated by the ability of that nation to consider scientific developments, which apparently were not of immediate military value, and to assist in them despite the demands of the war. The amount of time during which our experimenters could use the antenna was, of course, very limited, and was small as compared to their necessities. The permission to use the antenna at a time when France was wholly engaged in this bitter struggle represents a contribution to science altogether disproportionate to the time which the antenna was available to our men. Unfortunately, however, much of the time when Mr. Shreeve and Mr. Curtis had access to the Eiffel Tower antenna there was interference from other high power stations on the Continent, such as Nauen, Eilvese, Clifden, Norddeich, Lyons and Vienna which were transmitting upon the same range of wave lengths as it was necessary for us to employ. Instructions from Paris to Arlington, to alter the wave length of the transmission, could be forwarded only by cable, and were, of course, subject to days of delay, so that a satisfactory and flexible working schedule was not to be hoped for. Further, it was possible to transmit in any one day only for a brief period. In spite of these difficulties, promising results in the way of clearly received speech at Paris were secured during short periods that it was possible to arrange for working between October 12 and October 21. On October 23 as a final demonstration a number of observers, including Commander Sayles and representatives of the French Army, listened to the telephone transmission from the Arlington station 3600 miles away. The wave length used was about 6000 meters and the antenna current at Arlington about 50 amperes.

On certain of the occasions when we had worked to Paris, Mr. Espenschied at Honolulu had been informed as to the schedule of tests. He had therefore listened in and copied the words spoken at Arlington. The conditions at his stations were, of course, much better than at Paris because of the absence of interference from high power stations in the neighborhood. His observations were upon transmission over a distance some

25 per cent greater than that from Arlington to Paris, and in part over land as well as sea water.

Practical Developments.—The impending danger of war put an end to the experiments as far as they were concerned with increase in range of transmission. The possibility of applying the principles which had been successfully developed in connection with these experiments in trans-Atlantic and trans-Pacific radio telephony to problems of immediate and patriotic value was of course evident. Subsequent developments and experimental tests were therefore directed solely with an aim toward their military value to the army and the navy. Some of these experimental developments which we made in this connection and the success with which they were accompanied may be of interest.

The first opportunity to demonstrate the use of the wireless telephone in war was presented early in 1916. Secretary Daniels desired a demonstration of what could be accomplished in the way of mobilizing the telegraph and telephone facilities of the country in case of war-time need. This was carried out by the American Telephone and Telegraph Company in May, 1916, and included as part of it wireless telephone communication with a battleship at sea.

The part played by the wireless telephone was to show the possibilities of quick communication by word of mouth between vessels at sea and headquarters on land. A complete set was built and installed on the battleship *New Hampshire*. The transmitting to the battleship was done from our station at Arlington. The signals from the battleship were received at the navy yard at Norfolk with a set built for that purpose, and were automatically transferred to land telephone lines to Washington. The connections were brought directly to the mobilization switchboard at the Navy Department Annex. When it was desired to talk to the battleship, the regular telephone circuit from the Navy Department was connected up with the lines to Arlington and Norfolk, thus allowing communication by telephone to be held directly with the captain of the vessel. It was found entirely practicable to hold two-way radio communication as effectively as over wire lines and to secure information or to give orders. Captain Chandler received his orders for maneuvering in this experiment by wireless telephone from Secretary Daniels and Admiral Benson, and he reported to them each hour his position by the same means. The fact that the lines to the transmitting and receiving land stations came to Washington where these gentlemen were located did not mean that such an arrangement only was possible. The radio system was attached to the long distance telephone line and Captain Chandler talked with Lieutenant Snyder of the Great Lakes Naval Station. It was then connected with the Transcontinental Telephone Line and he talked directly with Captain F. M. Bennett, Commandant of the Mare Island Navy Yard. The ship during these conversations was 50 miles from Norfolk and outside the Capes.

The set installed on the *New Hampshire* differed from the set at Arlington only in size. The general circuit arrangement and modulation system was the same. The set was installed on the lower bridge deck and the telephone transmitter and receiver were installed on the bridge itself. This allowed the captain, while on the bridge and directing the movement of the ship, to converse without leaving his post.—Paper by E. B. Craft and E. H. Colpitts presented before A. I. E. E.

ENGINEERING

INTERNAL-COMBUSTION ENGINEERING.—*Performance of Marine Diesel Engines.*—Tests of Merchant-Ship-Type Diesel Engines.—Data of official trials of two 1200-i. h. p. (750-b. h. p.) Diesel engines built by J. Samuel White & Co. for the British Admiralty. The trials were carried out in

accordance with the special requirements of the British naval authorities and in the presence of their representatives.

The engines are direct reversible, two-cycle, single-acting, stepped-piston type, 6-cylinder, 14½-inch bore by 24-inch stroke, and have a weight complete of 70¼ long tons.

The trials of the first engine consisted of 96 hours of uninterrupted running at the full load of 750 b. h. p. at a speed of about 200 r. p. m.

During the whole trial the engine ran satisfactorily without any stoppage and without any sign of overheating either in the cooling system or working parts. The exhaust was quite invisible and very little soot was observed after the completion of the trial. The temperatures at the end of the trial were practically the same as those attained at the end of the first hour.

The circulating water was passed through the engine by steam pumps, the quantity per brake horsepower being approximately 11.2 gal.

Additional maneuvering trials were carried out with the port engine consisting of astern running, time taken to pump up the starting reservoirs, slow-speed running and the drop in pressure of the starting air after each start.

Table 1 is representative of the results obtained in the 96-hour trial of the starboard engine, while Table 2 gives data on lubrication and also the heat balance of the engine. (*Motorship*, vol. 4, no. 3, March, 1919, pp. 17-20, illustrated, *e.A.*)

TABLE 1.—DATA ON 96-HOUR TRIAL OF STARBOARD ENGINE

Mean b. h. p.	751.8
Mean r. p. m.	190.5
Mean i. h. p.	1215.6
Mechanical efficiency, per cent	61.84
Total revolutions for 96 hr.	1,097,307
Total lb. of fuel oil used during 96 hr.	35,205
Fuel per b. h. p. per hr., lb.	0.487
Total lubricating and cooling oil used for 96 hr., lb.	887.7
Mean lubricating and cooling oil per b. h. p. per hr., lb.	0.0123
Mean temperature of cooling water, inlet, deg. fahr.	61.5
Mean temperature of cooling water, outlet, deg. fahr.	99.5
Mean temperature of piston oil cooling, inlet, deg. fahr.	90
Mean temperature of piston oil cooling, outlet, deg. fahr.	125
Atmospheric temperature of test shop, deg. fahr.	61.5
Injection air pressure (mean), lb. per sq. in.	1000
Scavenge air pressure (mean), lb. per sq. in.	7
Air Compressors:	
I.P. air cooler pressure (mean), lb. per sq. in.	127
L.P. air cooler pressure (mean), lb. per sq. in.	27
Circulating cooling water pressure (mean), lb. per sq. in.	5
Piston cooling and lubricating oil pressure (mean), lb. per sq. in.	61.56
Compressor suction open, per cent of total	5.35
Mean indicated pressure of No. 1 cylinder, lb. per sq. in.	110
Mean indicated pressure of No. 2 cylinder, lb. per sq. in.	106.7
Mean indicated pressure of No. 3 cylinder, lb. per sq. in.	108.4
Mean indicated pressure of No. 4 cylinder, lb. per sq. in.	103.4
Mean indicated pressure of No. 5 cylinder, lb. per sq. in.	117.0
Mean indicated pressure of No. 6 cylinder, lb. per sq. in.	102.5

Blast air used per b.h.p. = 0.22 cu. ft.

TABLE 2.—DATA ON LUBRICATION—HEAT BALANCE OF ENGINE

	Lb.	Oz.
Oil for power and scavenge pistons and L. P. compressor pistons..	80	0
Oil for crankshaft and valve gearing	112	0
Oil for piston cooling and bearing lubrication	693	0
Total	885	0

(*i. e.*, 0.22 lb. per hour or 0.0123 lb. per b.h.p. per hr.)

HEAT BALANCE

Calorific value of fuel, B.t.u. per lb.	19,510
Consumption per b.h.p. per hr., lb.	0.487
Consumption per i.h.p. per hr., lb.	0.303
b.h.p. = 751.8, i.h.p. = 1215.6 } Mech. efficiency, per cent	61.84

$$1 \text{ b.h.p.-hour} = \frac{33{,}000 \times 60}{778} = 2550 \text{ B.t.u.}$$

1 b.h.p. requires 1.62 i.h.p., therefore frictional

$$\text{Heat per b.h.p} = \frac{0.627 \times 33{,}000}{778} \times 60 = 1578 \text{ B.t.u.}$$

$$\text{Heat taken in per b.h.p. per hr.} = 19{,}510 \times 0.487 = 9500 \text{ B. t. u.}$$

$$\text{i.h.p. heat units per b.h.p.} = \frac{1.62 \times 33{,}000}{778} \times 60 = 4120 \text{ B.t.u.}$$

	B. t. u.	Per cent	
Heat converted into work on brake	2550	26.9	} 43.5 per cent
Heat lost in engine friction	1578	16.6	
Heat converted into indicated work	4120	43.5	} 100 per cent
Heat lost in cooling water	2480	26.1	
Heat lost in exhaust gases	2900	30.4	
Heat taken in per b.h.p. per hour	9500	100.0	

Thermal efficiency of engine = 26.0 per cent

—*Mechanical Engineering*, 4/19.

ARC WELDING IN THE BUILDING AND REPAIR OF SHIPS.—By Robert G. Skerrett.—The seedless orange has ceased to be a marvel, but the rivetless ship is coming to amaze us, instead. True, the rivetless ship is not yet quite an accomplished fact, but it is measurably near. According to technicists, we may confidently count ere long upon steel craft securely bound together with no more than 20 per cent of their accustomed rivets in place—electric welding will do the rest of the fabricational work!

Offhand, this sounds little short of a veritable revolution in shipbuilding practice, and yet it is the logical climax of some years of successful work in metallurgical undertakings in which steel parts of a wide variety have been welded securely together both by oxyacetylene gas and by means of electricity. In large measure, however, the pressure of war and the compelling urge of a greatly stimulated building of ships to offset the toll of the submarine have speeded up an ever-widening recourse to electric welding in naval architecture. Technicists, far and wide, were fully alive to the time and labor involved in driving rivets, and quite naturally they asked: "Why can't we do away with these binding units and substitute the unionizing heat of the torch or the electric arc?"

Probably the most convincing answer to this query, gauged by extent and the scale of the departure, is the case of the English "cross-Channel" barge built at Richborough, England, and launched about the middle of last year. The craft in question, the *Ac 1320*, has an over-all length of 125 feet between perpendiculars, a breadth of 16 feet, and a displacement of 225 tons. She represents a good-sized experiment; and her design was purposely simplified in order to facilitate the employment of electric welding. That is to

say, her cross-section throughout the greater part of her length is rectangular, having only her bilge plates curved. Because of this, it was comparatively easy to erect the structure and to get her plates in position preliminary to welding. To hold them in place, *pro tem*, only a few bolt holes were needed; and after the lapped joints of the shell were welded the bolts were withdrawn, and the holes plugged with pins, which were, in their turn, sealed fast by the arc. The *Ac 1320* has met the stresses of service in an excellent manner and has had to contend with rough weather.

The hull plates of this novel vessel are lapped and the edges joggled, and this arrangement greatly aided horizontal downward welding. That is to say, the process of binding the contiguous surfaces together involved feeding molten steel into the upturned seam or lap. It was, in short, a sort of soldering process. Captain James Caldwell, of the Royal Engineers, has made it clear that there is a distinct economic gain to be realized in recourse to electric welding, but it is equally plain that the operator must be something of a specialist—probably more so than his corresponding rival who handles a rivet gun. This authority informs us:

"The operators were first-rate men, with extensive experience of electric welding in the shops and on structural work in shipyards. With the most difficult welding, such as vertical joints and overhead work, the quality of the welds was excellent. Quasi-arc electrodes were employed throughout, and for overhead work a special electrode was used. This proved well worth the slightly increased cost. All watertight joints up to and including the underside of the bilge plates were continuously welded both inside and outside, and the other watertight joints were welded continuously on one side and tack welded on the other. On the shell plating, the continuous welding was on the outside in all cases. For internal non-watertight joints and frame construction, tack welding was adopted sufficient to give a margin of strength over a similar riveted joint.

"Some interesting details are provided of the comparative cost of the electric welded and the riveted barges. In labor, 245-man hours were saved in constructing the welded barge. More than 1000 pounds of metal was saved by the substitution of welding for riveting, and even greater economy will result when the design is further modified to suit electric-welded ship construction. There were altogether 7000 lineal feet of welding on the barge, and over 3000 holes had to be filled up when service bolts were withdrawn. The total cost of welding was £301 ($1,459.85), comprising electrodes, £178 ($863.30); electric current, £61 ($295.85); and labor; £62 ($300.70). The cost of assembling similar barges in the same yard by the ordinary method of construction, including riveting, caulking, and drilling, was £389-8s ($1888.59), while in another yard, where ten barges were built, the average cost was £453-8s ($2198.99)."

When one realizes just how prime a part rivets play in the makeup of a modern steel ship, the value of electric welding becomes plain. In a cargo craft of 5500 tons deadweight capacity, for example, there are driven substantially 500,000 rivets, and in fabricating a 7500-ton freighter 650,000 rivets are needful to assemble and to bind together the various elements that make her a structural entity. A great many of these rivets, even with the aid of the pneumatic hammer, are driven under difficulties, and all too frequently a goodly percentage of the rivets in any vessel are found to be defective. This means that they must be cut out and driven anew. But this is by no means the whole story against the rivet.

Where plates are to be joined with angles or other plates corresponding holes must be bored in each contiguous surface, *i. e.*, at least two holes for every rivet, and in order to insure sufficient strength, lapping plates or butt straps may be double, treble, and even quadruple riveted. And what happens when these holes are not in line for the reception of the rivet? Where it is quite impossible by means of force applied in one way or another to bring the holes in alignment it is the custom to straighten out the passage by means of a reamer, and then to drive the rivet in a more or less

as a certainty that Congress will be promptly, if not eagerly, responsive to any suggestion contained in the league of nations covenant permitting the suspension of the building of fighting ships. It becomes a question at once, therefore, whether Congress will authorize the construction of more than the six battle cruisers which were authorized in 1916, and upon which construction, with the exception of the machinery, was suspended during the war to permit progress on the destroyers. It has been anticipated by the naval authorities that Congress would consent to additions to this number in view of the unquestioned value of the type in modern warfare. Then, it must be decided whether the ten battleships included in the program in the bill of the last session shall be battleships of the dreadnought type or the advanced type which approaches the battle cruiser. It is bound to be the occasion of an interesting discussion before the naval committees where, as usual, there is destined to be a difference of opinion among members encouraged, perhaps, as too frequently occurs, by failure to agree upon types and other details of design among the naval experts themselves. That, indeed, has always been one of the handicaps in the matter of obtaining prompt congressional approval of any departmental plan for naval fleet expansion. Naval committee members have been quick to take advantage of this situation and to insist, by way of defence for their inaction or procrastination, that they can hardly be expected to reach conclusions upon highly technical questions when the naval authorities carry their controversies on the subject to the Capitol for ventilation. The enlightenment of committees, which might be argued in justification of this proceeding, has the opposite effect frequently of providing an excuse for doing nothing. —*Army and Navy Register*, 4/5.

A FLEET FOR THE PACIFIC.—There will probably be during the next year a Pacific, as well as an Atlantic fleet; certainly, there will be a division of the present naval force between the two oceans or a division of time of one big fleet between the Atlantic and the west coast. If there are two commands of considerable dimensions, respectively, there will be an exchange of visits periodically and a program of joint maneuvers at least annually. The people on the west coast have been insistent upon this and the sentiment and desire have been growing with the increase in the number of the fighting vessels. Of course, nothing has been said during the war, when it was realized that the available ships were necessarily employed in the war zone or held in readiness for assignment to duty abroad. Now, with the cessation of hostilities, the request from the west coast is likely to be renewed in stronger terms than ever, especially as there is apprehension in that quarter of the unfriendly, or at least suspicious, activities of the Japanese. In that connection it is interesting to learn that the State Department has formally announced its intention to thoroughly investigate the persistent rumors of Japanese acquisition of a naval base in Southern California through some sort of secret treaty with the Mexican Government. Significance is imparted to the incident largely from the unusual circumstance of the official admission of the purpose of the State Department, since, ordinarily, such an action would be conducted with as little publicity as possible. However, with or without a Japanese "war scare," that usually makes its appearance about the time the naval appropriation bill is reported from committee, there will be a determination to have a formidable and permanent representation of naval power on the west coast, while the presence of Senator Poindexter of Washington, as chairman of the Senate naval committee in the 66th Congress, will be a direct and positive contribution to that end. For the first time in many years the west coast will have an important "say" in the deliberations of a naval committee of Congress and, as in the old days, New England, and more recently, southern influence has affected legislation, so it may be expected that west coast influence will do something more than hitherto for the navy yards on the Pacific coast and toward having a fleet in that ocean.—*Army and Navy Register*, 4/5.

From the very nature of things, it is desirable that overhead welding, *i. e.*, welding from the under side, should be held down to a minimum, and much of this can be avoided by doing this work while the parts to be joined in this manner are lying flat either in the shops or on the ground prior to setting up and assembling at the building slip.

Electric welding may be broadly divided into two methods: one is the arc-welding process and the other is the so-called "spot" and butt-welding process. Both of them are akin only so far as they have recourse to heat induced by the action of an electric current which serves to raise the temperature of the metals to be joined to a point where they will unite either by reason of added molten metal or by the application of pressure at the right moment. To prevent confusion it might be just as well to take up spot and butt-welding first, because this method is industrially the older one, although not so widely known or so generally practiced as arc welding.

Without going too much into details, the spot-welder apparatus consists of a suitable jaw or yoke equipped with copper electrodes between which are placed the pieces of metal which are to be heated and welded. A suitable current is then passed from electrode to electrode by way of the intervening material, which is held firmly together. The resistance to the flow of the current offered by this metal causes incandescence just as does the filament in an electric bulb, and when the steel, let us say, is glowing brightly the copper electrodes exert pressure and produce a weld at the point of contact, hence the term spot welding. This method of welding can be done by fairly unskilled labor, and satisfactory work can be effected rather rapidly. It will be realized that the union of the contiguous surfaces takes place only at each weld or spot, and, in this respect, is somewhat similar to the local binding action of rivets.

In butt welding, the pieces of metal placed between the jaws are set there so that the edges project somewhat beyond the electrodes, and because their surfaces are in contact, when heat and pressure are applied, the weld extends over the whole of the meeting surfaces and is, accordingly, a wider and stronger unit junction. In other words, it is virtually nothing more than amplified spot welding, and the same apparatus serves for both types of welds.

In arc welding much greater nicety of manipulation is required on the part of the operator, for success depends very largely upon his control of the heat induced by the arc, his maintenance of a fairly continuous arc, and the manner in which he fills in the deposited molten metal which constitutes the binding tie between the surfaces to be joined. Care, a cunning hand, and a sure eye are required even after the surfaces to be welded have been properly cleaned and otherwise made ready to be "soldered," so to speak. The electric arc, as most of us know, is the intense spark or flame produced by the current in spanning the air space between the electrodes of a broken or separated circuit. Now see how this phenomenon is applied to welding.

The materials to be welded are connected to one side, so to speak, of the electric circuit, and the electrode, which is directed by the operator, forms the other terminal. With the surfaces to be welded properly cleaned, the electrode is placed in contact, the current is turned on, and then the worker "strikes the arc" by slightly withdrawing the electrode which he holds. Instantly, the current jumps the gap which, depending upon the nature of the electrode, may range from 3/16 of an inch to 2 inches. The air space offers high resistance to the flow of the electricity, and this resistance promotes the generation of the intensely hot arc. For a satisfactory weld, it is essential that the worker should keep the electrode at a fairly uniform distance so that the arc will be steady and not a succession of discharges. Otherwise, the molten metal, instead of being deposited evenly, is laid in the form of "beads" of varying sizes, producing a spongy weld, and inviting oxidation. This objection applies especially to the use of the metallic electrode when manipulated unskilfully.

at the end of the three-year period in that grade should be competitively examined for promotion to the grade of lieutenant, junior grade, leaving the latter grade the only one from which advancement to the next higher grade will be by seniority alone. There are, however, some objections to this proposed examination of the ensigns. It is pointed out, for one thing, that officers of this grade are apt, in many instances, not to have found themselves until later on in their career; on the other hand, it is insisted that the competitive examination will keep the ensigns keyed up to a standard of fitness which otherwise they may be prone to ignore. An additional objection, which is apt to have more influence, arises from the difficulty of conducting so many examinations as will be necessary in the course of a year in all parts of the world constituting an administrative situation that may be successfully urged against Mr. Daniels' plan in this particular.—*Army and Navy Register*, 4/5.

FIXING NUMBER OF NAVAL OFFICERS.—It need surprise no one in the navy or marine corps if a proposition is made in the naval committee of the next Congress to repeal existing law which provides for automatic increase in the number of commissioned officers of all grades and branches, and a return to the old method of maintaining a fixed number in each grade of line and staff, to be changed only by special authorization of Congress. There is objection expressed by some committee members to the system which bases the strength of commissioned personnel upon the number of enlisted men, despite what these critics admit is a plausible argument in its favor. It is evidently felt that advantage may be taken of this arrangement to create too many officers and to furnish special and extraordinary opportunities for adding to the number of commissioned officers. There is also a very well defined notion in the same quarter that the present sources of officers will be sufficient for the purpose of the service, considering the reserve personnel and the graduates of the Naval Academy. Indeed, there is a feeling that more should be done for the reservists in the way of promotion and in a provision for transfer to the permanent establishment. On the other hand, no such change is contemplated by the Navy Department and the proposition is not likely to receive the support of the Secretary of the Navy if he has an opportunity to pass upon it. It is certain to incur the opposition of the naval authorities, whose view in the matter is destined to have much weight with the conservative element in Congress.—*Army and Navy Register*, 4/5.

OPERATIONS.

SUBMARINE CHASERS ORDERED TO ALASKA FOR PATROL WORK.—Acting Secretary of the Navy Roosevelt authorizes the following:

Under the direction of the Navy Department a detachment of four submarine chasers has been ordered to Alaskan waters. The chasers will be accompanied by the gunboat *Vicksburg*, which will be the mother ship of the detachment, with two chasers operating at all times, two being held in reserve.

These vessels have been ordered to leave the navy yard, Puget Sound, about April 1, 1919, and to proceed to Juneau, Alaska, from which port they will operate until navigation closes.

Duty of Detachment.—This detachment will have on board fish wardens of the Department of Commerce, and have orders to cooperate with the officials of the Department of Commerce, the Treasury Department, and the Department of the Interior in enforcing law in Alaskan waters, rendering assistance to shipping and natives in distress.

The coast-guard cutters *Unalga* and *Bear*, operating under the direct orders of the commodore commandant, United States Coast Guard, pursuant to general instructions of the Navy Department, will also operate in Alaskan waters from about April 20 to October 1. The patrol by these coast-guard cutters is similar to that which has been maintained by the United States Coast Guard for several years past.—*Official Bulletin*, 3/24.

across the Atlantic. The damage to the vital parts of these vessels was of such a staggering extent that it was not considered practicable to put them in shape for service by ordinary methods in less than a year and a half. As a matter of fact, thanks to the "Plastic-Arc" and the courage of certain of our naval engineering specialists, the trick was done in six months and a total of 288,780 gross tons of sorely needed shipping was put in shape for oversea duty. Not only was a whole twelvemonth saved but an economy amounting to quite $20,000,000 was effected.

Instead of casting new cylinders and other essential parts, the wrecked sections of the engines were patched up, so to speak, just where they stood in the several craft concerned, and all that was necessary was to provide pieces to fill the fractures and to bind them firmly in place by means of electric welding. As has been said: "Arc welding on such a scale was unprecedented, but, no preheating being necessary, there being consequently no fear of distortion, the work was done without removing the cylinders. At the completion of repairs each vessel was sent to sea for a test under full power conditions for 48 hours, to ascertain whether or not the repairs were lasting, and also to determine if the ships were in condition to be trusted with the important work of transporting troops to Europe, especially when speed alone was to be depended upon in avoiding enemy submarines. Not a single defect developed on the test runs and not a single failure of the repaired parts of these ships has occurred despite the fact that they have been driven back and forth across the ocean at top speed for months."

To-day, electric welding is playing a conspicuous part in the overhaul and repair work going on at many of our shipyards, and a vast deal of time and expense is being saved in this way. The whole subject is in a state of flux, and, month by month, the inventive mind, the engineer, and practical experience are showing ways of effecting improvements. The spot welder, in the form of a yoke with a 5-foot gap, from end to end—not between electrodes—has been developed which will make it practicable to "tack" plates and parts in position, after which they can be completely welded, if needful, by the electric arc. It is believed that this will enable the shipbuilder to do away with the punching of holes and the temporary use of bolts during setting up, and will also make it feasible to bind together different elements of a ship which need not be made watertight but secured at suitable points. It is the opinion of numerous technicists that riveting can be very largely eliminated in the building of steel vessels; but for the present, at least, these binders will probably be found the more satisfactory at the bows and sterns of craft where the somewhat complex forms make it necessary to use considerable force in drawing the shell plating into place.—*The Rudder*, April.

AERONAUTICS

NAVY OCEAN FLIGHT PLANS IN DETAIL.—The navy's plans for a transatlantic flight have progressed to the point where it is now possible to give some of the particulars of the project in greater detail.

The preparations call for the use of two large naval seaplanes of the *N C* type, both of which will be started at the same time, carrying five men each. They will fly from the Rockaway (L. I.) Naval station to the east coast of Newfoundland some time after May 1, but very close to that date. This flight will not be a part of the transatlantic voyage, which will start from the east coast of Newfoundland.

It is not the plan to fly direct from Newfoundland to Ireland or England. The route will be from Newfoundland to the Azores and from the Azores to the nearest point on the coast of continental Europe, somewhere on the west coast of Portugal.

It is not the purpose, as has been previously intimated, to divide the leg between Newfoundland and the Azores into two parts. The idea now is to have the two planes continue to those islands for their first stop. About

of the phases of unrestricted private control, which caused me considerable concern, was the possibility that under such control, ships would be over-capitalized as were many of the railroads. We want the initiative and skill of American ship-operators, but we want no watered stock. We want to avoid the stagnation that sometimes comes from red-tape and bureaucracy, but we want no profiteering nor exploiting.

We want the new fleet used for the benefit of the people of the United States and not against their larger interest. We want it used for the development of the nation's commerce, and not merely for the development of the private fortunes of ship-operators. No one will deny that our foreign trade, or the operation of American ships, will decline unless there is a profit for the men who invest their money, but whatever assistance the government is willing to render, should be reciprocated by those who are benefited. Therefore, the nation's shipping policy should certainly provide for such governmental representation as will guarantee a square deal to the public.

I think the whole nation is agreed that there must be no more scandals of overcapitalization in any part of American industrial or commercial life. The ships built by the nation should never be made the basis for any stock-jobbing scheme. The mere possession of large capital must not give the larger operator an opportunity to drive the smaller man out of business. In the plan I am ready to submit for the best thought and impartial discussion of the country, I believe you will find that the American theory of encouraging competition on fair terms is amply safeguarded.

In my judgment, any policy which does not encourage the building and the extensive operation of ships under the American flag will not satisfy the American people. I believe that a sound policy can be put into the form of legislation and that it will then form a permanent foundation for further improvements, as the need for them appears.

The United States Government now owns 555 ocean-going steel cargo ships aggregating 3,385,475 deadweight tons. In addition it has under contract 1336 similar vessels of 9,275,006 deadweight tons. If our present program be carried out, there will be under the American flag next year 16,732,700 deadweight tons of ocean-going steel cargo and passenger ships. This fleet will be the equivalent of almost half the merchant tonnage which plies the seas to-day under the flags of all nations combined. The government will own about 70 per cent of it.

The economic importance of this great fleet would be difficult to overestimate. Upon its successful operation under a sound financial and administrative plan by vigilant, courageous men who have the interest of American industry and commerce at heart, depends more than upon any other factor the future development of our overseas trade and of the domestic industries which feed it. With this brief review of the situation, I now submit this proposed plan of operation:

That the ships should be sold to and operated by American citizens under no restrictions other than the terms of the bill of sale and the fixation of maximum freight rates, either as provided in Section 18 of the Act approved September 7, 1916, or as may be agreed by the government and the operator in specific instances.

The ships should be sold at a price which fairly reflects the current world market for similar tonnage.

Twenty-five per cent of the purchase price of each ship should be paid down, the remainder falling due and payable in graded annual installments over a period not exceeding ten years. The government should take and hold a mortgage for the unpaid balance, charging interest thereon at the customary commercial rate of five per cent. One-fifth of this interest, representing the difference between the customary government interest of 4 per cent and the customary commercial rate, should be paid into a Merchant Marine Development Fund to be described hereafter.

The purchaser should be required to agree to insure and keep insured with an American marine insurance company, his equity in the vessel, and

"There will be a hasty conference between the stations, and within five minutes the navigator will be able to mark on his map exactly what his position was when he sent his enquiry.

"Fitted with 'directional' wireless and a good compass the airplane will be able to steer through fog or clouds without getting more than a trifling distance off its course."—*N. Y. Times*, 4/3.

British destroyers will cooperate with the American Navy in patrolling the course to be followed by American naval seaplanes in the projected flight across the Atlantic Ocean next month. It was learned to-day at the Navy Department that 40 to 50 British ships would be on duty from the Azores to the British Isles, where, under present plans, the flight will end.

American destroyers will patrol the course from St. John's, N. F., to the Azores. Fifty to sixty craft will be used and they will be stationed at intervals of less than 200 miles.

Along most of the course there will be an almost continuous stream of army transports going to and returning from France, and these vessels will form additional safeguards for the crews of the the machines in event accidents force any of the craft to descend. With reasonably good weather, however, the planes could ride on the water while minor repairs were being made to the motors.

The course of the flight will be charted in advance by naval vessels. Careful study is being made of weather conditions and the winds prevailing. As the result of experiments with radio telephones some naval officers think it will be possible for the planes to be in communication with shore throughout the flight. Each boat will be equipped with wireless outfits so as to maintain contact with patrolling destroyers and passing transports or other vessels.—*N. Y. Times*, 4/3.

BUREAU OF MINES SEARCHING FOR SPECIAL AIRPLANE FUEL.—During the war the Bureau of Mines, Department of the Interior, made strenuous efforts to find a special fuel for airplanes that would be superior to others already in use. Of the numerous products and mixtures obtained some were originated by the bureau engineers and chemists, others were suggested by outside interests. Through its own experiments or by cooperation with other organizations, notably the research division of the Dayton Metal Products Co., and the Bureau of Standards, it was possible to establish the fact that certain types of fuels had elements of superiority that had not before been noted or appreciated. Of the fuels proving most satisfields was distinctly superior to the type most extensively used. The blendfactory, gasoline refined from the crude petroleum of certain producing fields was distinctly superior to the type most extensively used. The blending of moderate proportions of benzol with gasoline was found to be distinctly advantageous, and motor fuel of this type would undoubtedly have been employed for military purposes if the war had continued much longer. It is believed that through the proper use of benzol and other distillates derived from coal, it may be possible to embody features in the design of internal combustion motors that will notably increase their efficiency. Benzol and other coal-derived fuels are already being sold for use in automobiles and are believed to be giving satisfactory results even with present types of motors.

The bureau was particularly interested in a special fuel tested in cooperation with the Dayton organization and named "hecter." This fuel was a mixture of cyclohexane and benzol, gave indications of marked superiority over any other product tested and should, unless unforeseen deficiencies appear, prove ideal for the military aviation service. In some experimental flights this fuel has given 10 miles an hour more speed. It is not certain that the cost of production will ever be low enough to permit its use in peace times, but it is planned to complete the work of obtaining comprehensive information regarding all of its possibilities and to

publish reports on the subject in cooperation with the engineers of the research division of the Dayton Metal Products Co.—*Official Bulletin*, 3/19.

TELLS OF AUTOMATIC PLANE.—*Flew 100 Miles Without a Pilot Secretary Baker Reveals.*—Under automatic control, an airplane capable of carrying a heavy load and operated without a human guide, has made a trip of 100 miles and landed close to the point it set out to reach, Newton D. Baker, Secretary of War, disclosed in an address here to-day. Secretary Baker, with General Peyton C. March, Chief of Staff, came here to inspect Camp Bowie.

The device which made such a flight possible, and which has been kept secret, Mr. Baker said, is an automatic guide for airplanes, and was invented in America. It is designed as an instrument of war and the Secretary referred to it in describing to his audience the possible horrors of future wars if there is to be no League of Nations.

Secretary Baker did not explain the exact nature of the invention, but he made it clear that the War Department considered it one of the most wonderful pieces of mechanism for war's destructive purposes.—*N. Y. Times*, 3/25.

A remarkable long-distance flight over the North Sea, the longest nonstop oversea voyage of any British aircraft, has been performed by the nonrigid airship *N S-11*. The voyage, which took the form of a circuit embracing the coast of Denmark, Schleswig-Holstein, Heligoland, North Germany, and Holland, was characterized by extremely unfavorable weather conditions. The total length of the round trip was 1285 air miles, the time taken being 40½ hours.—*London Army and Navy Gazette*, 3/29.

BRITISH TRIPLANE CAN CARRY 100 PERSONS.—*Built to Travel Loaded 1200 Miles at More Than 80 Miles an Hour.*—The *Daily News* gives further particulars of the Tarrant super-triplane which Major Gen. Seely referred to in the House of Commons on March 13 and which is being assembled at the royal aircraft factory at Farnborough.

A striking feature is its long cigar-shaped fuselage, similar in appearance to the body of the Zeppelin machine. It was originally designed to bomb Berlin, carrying 10,000 pounds of bombs and a crew of eight over a distance of 1200 miles. It has a span of 141 feet, the fuselage is 85 feet and is fitted with six Napier Lion 506, engines.

When the aircraft industry began preparations for commercial flying the makers of the super-triplane followed suit, with the result that this type will be capable of carrying over 100 passengers, or cargo weighing nine tons, for a distance of 1200 miles. The speed of the converted machine will be anything from 80 to 100 miles per hour. It possesses enormous possibilities in continuous flying, and by extra tankage it would be possible to make a nonstop flight lasting 24 hours.

The fuselage is built of wood and strengthened by a patent system of girders not unlike the masts of an American warship, and this obviates the use of tracing wires and other fittings common to the ordinary airplane. There is freeway right down the center of the fuselage permitting anyone to walk to the tail. Three rows of glass windows, giving the appearance of portholes, will be fitted inside of the triplane, and tiers of seats will be provided for passengers.

In addition to the staff of pilots there will be on board two or three engineers and mechanics, a navigator, and a wireless operator.—*N. Y. Times*, 3/29.

WATERPROOFING AIRPLANE PROPELLERS WITH ALUMINUM LEAF.—A waterproof coating for airplane propellers, which incorporates thin aluminum leaf in the finish, was developed by the Forest Products Laboratory at Madison, Wis., and placed in production by the War Department. The

process is practically 100 per cent effective in preventing absorption of water, particularly in the storage stage. A French authority states that 80 per cent of the French propellers produced are rejected by the pilots mainly because they are out of balance. The difficulty is due largely to unequal absorption or distribution of moisture and can be greatly reduced by an effective waterproofing coating.—*Scientific American*, 3/15.

MISCELLANEOUS

INCREASE OF MOBILE ARTILLERY EQUIPMENT SINCE THE CIVIL WAR.—The following statement was prepared by the Statistics Branch, General Staff, War Department:

As a result of the Napoleonic wars the ratio of field guns to infantry armed with rifles became established at about 300 to 100,000. There were then no mobile guns other than those corresponding to the light field gun of the present, although heavy guns on fixed mounts were used to some extent in sieges.

Rifle strength is estimated in certain of the earlier cases as 85 per cent of combatant strength exclusive of cavalry. The heavy howitzers and railway artillery of the present war are excluded, on the ground that they are analogous to the old siege artillery, although to a certain extent mobile.

	Guns per 100,000 rifles	
	3-inch field	Others to 6-inch
Civil War, 1861-1865:		
Union (Bull Run)	192	....
Union (average)	386	....
Confederate (average)	[1] 418	....
Franco-Prussian War, 1870:		
French	[2] 228	....
German	267	....
Russo-Turkish War, 1877-8: Russian	354	....
Russo-Japanese War, 1905:		
Russian	[3] 356	25
Japanese	357	28
Peace basis (spring, 1914):		
French	466	21
German	412	198
War basis (October 1, 1918):		
United States	484	251
German (June 1, 1918)	498	541
British	566	529
French	714	712

TURKEY'S WAR LOSSES.—A Turkish official return gives the total losses of the Ottoman Army from the beginning of the war to the end of 1918 as:—Killed and died, 5550 officers and 431,424 men; wounded, 407,772 (officers and men); prisoners and missing, 3030 officers and 100,701 men.—*Reuter.*

The figures having reference to prisoners and missing appear to be underestimated, for it will be remembered that General Allenby during his last offensive, in conjunction with the Hedjaz Army's operations, took over 83,000 prisoners, while there is also to be taken into account the number of Turks captured in Mesopotamia, Egypt, Armenia and Gallipoli.—*Army and Navy Gazette*, 3/1.

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[1] Nine and twelve pounder as against 12- to 20-pounder, Union.

[2] Muzzle loading as against German breech-loading. In addition, French had 53 mitralleuses per 100,000 men.

[3] Used only shrapnel for field-gun ammunition.

currents, and the differences in amplitude and in phase of an electro-magnetic wave at different intervals of time. Two electric currents are induced in the antenna, the one when the magnetic wave comes in contact with the nearer side of the arial, the other when it reaches the farther side. These induced currents will be in the same direction, and consequently will tend to "buck" or counteract each other. But, due to the differences in amplitude and in phase of the magnetic wave at the two points of contact, the induced currents will be of different strengths; and, although the one tends to obliterate the other, the difference in strength between them is conserved and heard in the telephones. However, if an incoming electro-magnetic wave strikes the plane of the antenna perpendicularly, the currents induced in both sides of the compass will be equal in strength, of the same phase and amplitude, and will neutralize each other. No sound is then heard in the telephones. By means of the rotating antennæ, the angle at which an electro-magnetic wave acts on it can be controlled by the operator. Thus the intensity of an oncoming signal can be increased, diminished or completely tuned out by a turn of the wheel. It is evident, then, that when the plane of the antennæ is parallel to the direction of the oncoming wave, the sound heard in the phones will represent the maximum strength of the oncoming wave. By turning the antennæ until this point is found, the maximum strength of any signal can be ascertained; and consequently, the position of the ship or shore station sending it will be disclosed. But to be more accurate, two positions are made known, 180 degrees apart. By consulting the diagram, the reason for this is apparent. It will be observed that two waves coming from opposite directions will affect the radio compass in the same manner.

In actual practice, however, a shore station operator knows that the coast line limits the arc of the compass in which he may expect to locate a ship. Moreover, to secure the best possible results in the every-day operation of the radio compass in guiding vessels into the port of New York, five radio compass stations have been established at strategic nautical points on the coast near New York. Each station is connected by a land line telegraph instrument with a central controlling radio station located in the office of the District Communication Superintendent, at 44 Whitehall St.

The close connection between the compass stations and the control station simplifies the details of communication with vessels at sea. Within a few minutes a ship may receive definite information as to its position. When a ship approaches the 50 or 100-mile coast line, the operator abroad calls New York and asks for his bearing. The ship does not get into direct communication with the various compass stations as they are equipped only with receiving sets, and so cannot reply. However, the radio operator at the central controlling station, in answering the ship's call, transmits a signal to the ship to send its call letters for 30 seconds. At the same time, a telegraph operator at the control station notifies the various compass stations, by means of a three letter signal sent simultaneously, to obtain a bearing on the ship sending her call letters. Immediately the various stations in the district, at Montauk Point, L. I., Fire Island, L. I., Rockaway Beach, L. I., Sandy Hook, N. J., and Mantoloking, N. J., turn their compass wheels until an accurate bearing is obtained at each station. This is transmitted to the telegraph operator at the control station, who waits until all stations have sent their bearings before turning them over to the radio operator. The latter, when all the compass stations have been heard from, flashes by radio the bearing, in degrees, of the ship on the different shore stations. An acknowledgment from the ship of the receipt of the desired information completes the operation.

The accuracy of the bearing reported by each compass station is determined at the control station by consulting a map of the coast which is arranged with an ingenious device for the particular purpose it serves. The map, spread out on a large table, is covered with glass. Holes are punctured through the glass at the center of the large circles drawn about the various

BEHIND THE BATTLE LINES

Railway locomotives sent to France	967
Freight cars sent to France	13,174
Locomotives of foreign origin operated by A. E. F.	350
Cars of foreign origin operated by A. E. F.	973
Miles of standard gauge track laid in France	843
Warehouses, approximate area in square feet	23,000,000
Motor vehicles shipped to France	110,000

ARMS AND AMMUNITION

Persons employed in about 8,000 ordnance plants in U. S. at signing of armistice	4,000,000
Shoulder rifles made during war	2,500,000
Rounds of small arms ammunition	2,879,148,000
Machine guns and automatic rifles	181,662
High explosive shells	4,250,000
Gas shells	500,000
Shrapnel	7,250,000
Gas masks, extra canisters, and horse masks	8,500,000

NAVY AND MERCHANT SHIPPING

Warships at beginning of war	197
Warships at end of war	2,003
Small boats built	800
Submarine chasers built	355
Merchant ships armed	2,500
Naval bases in European waters and the Azores	54
Shipbuilding yards (merchant marine) increased from 61 to more than 200.	
Shipbuilding ways increased from 235 to more than 1,000.	
Ships delivered to Shipping Board by end of 1918	592
Deadweight tonnage of ships delivered	3,423,495

FINANCES OF THE WAR

Total cost, approximately	$24,620,000,000
Credits to 11 nations	8,841,657,000
Raised by taxation in 1918	3,694,000,000
Raised by Liberty Loans	14,000,000,000
War Savings Stamps to November, 1918	834,253,000
War relief gifts, estimated	4,000,000,000

—*N. Y. Times*, 4/6.

NAVY WILL CONDUCT NATIONAL RIFLE COMPETITION THIS YEAR.—*Location and Date Not Yet Decided, but Matches Will Be Held Sometime in August.*—Acting Secretary of the Navy Roosevelt announces that at the invitation of the War Department the United States Navy will conduct the national matches for the year 1919, and that these great competitions, wherein soldiers, sailors, marines, and civilians compete for national marksmanship honors, will be held on one of the large rifle ranges. The exact location and date have not yet been determined but the matches will be held sometime in August.

Lieut. Col. William C. Harllee, United States Marine Corps, who has been active for many years in matters pertaining to marksmanship and who conceived the idea for the chain of navy rifle ranges which were put into commission during the war, has been named executive officer of the competitions. On the staff will be named officers from the army, navy, marine corps, and the National Rifle Association.

The national matches have been staged at frequent intervals during the past decade, and are the means of determining the national rifle and pistol championships.

At the matches are usually in attendance 50 or more teams representing the services national guard and civilian organizations, colleges, military schools, and many hundreds of individual marksmen. This year, owing to rifle practice, 100 teams are expected to compete.

The policy of admitting civilian teams, one or more from each state, inaugurated in 1919 will prevail in the 1919 competitions. Particulars in regard to the admission of teams and other arrangements for the matches can be secured by addressing Executive Officer, National Matches, Room 1108, Woodward Building, Washington, D. C.—*Official Bulletin, 3/22.*

GERMANS TOOK 4765 U. S. MEN; 4376 REPORTED FREE, 233 DEAD.—The Statistics Branch, General Staff, War Department, issues the following:

Revision of prisoners records, which have been compiled from reports of prisoners from all sources, for the purpose of eliminating duplicate names, brings the total number of military prisoners taken to 4765. Of these 4376 have been reported released and 233 dead. The list of 156 names of prisoners whose status is still doubtful was forwarded on March 20 to the Central Records Office, A. E. F., for checking and investigation.

The record of army, marine, and civilian prisoners taken by the central powers as of March 20, is as follows:

	Army	Marine	Civilian
Taken prisoners	4,686	79	281
Died	229	4	...
Release recorded	4,304	72	116
Status doubtful	153	3	165

The following table shows by rank the number of military prisoners taken and the number reported dead:

	Taken prisoner	Died
Lieutenant colonel	1	...
Major	4	...
Captain	27	3
First lieutenant	262	29
Second lieutenant	101	17
Total officers	395	49
Enlisted men	4,370	184
Total	4,765	233

—*Official Bulletin, 3/26.*

A TIME-HONORED CUSTOM THREATENED.—According to the Portsmouth correspondent of the *Times*, there is some possibility of the time-honored custom of hoisting the Union flag at the peak and firing a gun on the occasion of a court-martial being abandoned. It seems that the practice has fallen into disuse during the war, owing to the majority of courts-martial being held on shore instead of afloat—to allow of which the Naval Discipline Act was amended in March, 1915. Formerly, courts could only be convened on board ship, and it may be recalled that a special act of Parliament was needed in George III's reign to enable the trial of Admiral Keppel to be held on shore by reason of the infirm state of the admiral's health. The last time the practice of hoisting the Union flag and firing a gun was carried out was when Admiral Troubridge was tried by court-martial at Portland in 1914. Merely because it is a pity that old customs should disappear we venture to protest against any decision being hastily

taken in this matter. It would be interesting to know when the practice of hoisting a flag to denote the venue of the court-martial was instituted and whether it was ordered or, like many other naval customs, was observed without being specially sanctioned by law. The *Manual of Naval Law* is silent on the point, although it does show that a custom as the laying of his sword *across* the table when the prisoner is an officer and *along* the table with its hilt towards him if acquitted, and *vice versa*, has long ago been embodied in the regulations.—*London Army and Navy Gazette*, 3/1.

PROPERTY OF OUR ARMY WILL BE SOLD TO FRANCE.—Docks, railroads, warehouses, hospitals, and barracks built by the American Expeditionary Force, to the value of $165,000,000, will be sold to France for the best figures the American Liquidation Commission can obtain. None of these can readily or profitably be removed, and the only alternative is to sell at the best bargain.

The Liquidation Commission is now negotiating for the disposal of various surplus properties belonging to the expeditionary force. Hundreds of thousands of uniforms have been dyed, so that they may now serve other armies, such as those of Belgium, Poland, and some of the Balkan States.

The present plan is to dispose of these surplus supplies among the governments which need them.—*N. Y. Times*, 3/19.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

WORLD'S WORK. **April.**—How Beatty Put to Sea, by *Lieut. Francis T. Hunter*, U. S. N. R.

CENTURY. **April.**—The Larger American Navy, by *Rear Admiral Charles J. Badger*, U. S. N. China's Case at the Peace Conference, by *Thomas F. Millard*.

SCIENTIFIC AMERICAN. **March 22.**—U. S. Navy 7-inch Caterpillar Mount, by *Commander H. Delano*, U. S. N.

March 29.—Radium and Radio-Activity, by *Charles H. Viol*. A 121-Mile Gun, by *J. Bernard Walker*.

April 5.—Hunting Submarines with a Sound Detector, by *Brewster S. Beach*. U. S. S. *New Mexico*, by *Henderson B. Gregory*.

April 12.—The New American Merchant Marine (I), by *Edward W. Hurley*. The Marine Diesel Oil Engine, by *John W. Anderson*. Salvage Work in New York Harbor. Is the Dirigible Outstripping the Airplane?

FLYING. **April.**—Who Will Be the First to Cross the Atlantic? by *Henry Woodhouse*. A Proposed Airplane Route Across the Atlantic, by *Prof. Wm. H. Hobbs*.

FRANKLIN INSTITUTE. **April.**—The Visibility of Airplanes (illus.), by *M. Luckeish*. The Color of Water, by *Wilder D. Bancroft*.

GREAT BRITAIN

EDINBURGH REVIEW. **January.**—Ships and Empire, by *David Hannay*.

NINETEENTH CENTURY AND AFTER. **March.**—Could the Fleet Have Forced the Straits? by *Major Gen. Sir Charles Callwell.*

QUARTERLY REVIEW. **January.**—The Freedom of the Seas, by *J. Pawly Bate.*

ENGINEERING. **March 21.**—The War Development of the Torpedo-Boat Destroyer (five pages of illustrations). Naval Engineers.

March 28.—H. M. Seaplane Carrying Ship *Argus* (illus.)

CONTINENTAL

RIVISTA GENERALE DE MARINA. **Spain.**—Movement of Floating Mines in the North Atlantic and Arctic, by the *Prince of Monaco.*

DIPLOMATIC NOTES

FROM MARCH 20 TO APRIL 20

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

PEACE TREATY READY FOR GERMANY

FOUR PREMIERS ACT ALONE.—On March 24 it was announced that the so-called "Council of Ten" of the Peace Conference had been discontinued except as a war council to consider immediate military questions, and that, in order to expedite work on the peace treaty, consultations would thereafter include only President Wilson and Premiers Lloyd George, Clemenceau, and Orlando.

FRENCH DEMAND SAAR COAL FIELDS.—On March 28 Premier Clemenceau further complicated the frontier problem by presenting a demand that France should be restored to the boundaries fixed by the Treaty of Paris, of May 30, 1814, together with the Saar Basin. In the Rhine Province, on the left bank of the Rhine, Premier Clemenceau also requested that while the Germans should have political autonomy, they should not be permitted to establish fortifications, occupy the territory with armed forces, nor control the railways.

After continued negotiations, it was announced by the middle of April that the Peace Treaty would dispose of the Saar question by giving the coal mines to France in fee simple, as a recompense for destroyed French mines, and by granting territorial control to France for 15 years, under supervision of an international commission of five members. At the end of 15 years the inhabitants would choose their allegiance by a plebiscite.

An Associated Press despatch from Berlin, April 14, declared the Ebert Government would "resolutely reject any proposal to tear the Saar territory from Germany by means of a general plebiscite."

GERMANY THREATENS PASSIVE RESISTANCE AND BOLSHEVISM.—Semi-official announcement of the terms of the Peace Treaty in April stirred Germany to threats of refusal to sign and of a policy of passive resistance. On April 14 the *Tageszeitung* reported that the Berlin Cabinet, soon after the Hungarian Revolution, had considered an offer of alliance and an army of 500,000 men from Russia. But active resistance by Germany was regarded as out of the question.

Anticipating Germany's refusal to sign the treaty, the Peace Conference requested Marshal Foch to consider the measures to be employed in such a contingency. Continued blockade, cutting off of food supplies, and further occupation of German territory were suggested.

Semi-official French announcements of the conditions to be laid down in the treaty of peace are denounced by the German press.

Prince Lichnowsky, in an article in the *Tageblatt,* says that France "forgets that, instead of leading to disarmament, an unjustly extorted peace will bring forth only fresh armaments, throwing into the shade all former armaments, because a mailed-fist peace can be maintained only by the mailed fist."

Declaring that a peace of violence must be absolutely rejected, he concludes:

"Nobody can recommence the war against us. Neither can we be starved out, without the common enemy, communism and terrorism, throwing all mankind back into its primitive state."

Vorwärts says:

"No German Government can sign such terms. The entente statesmen must themselves settle with the inhabitants of the Sarre Valley, who are thoroughly German, and they may find that the sums proposed as indemnity cannot be extracted, even if the last sheet is taken from our beds."

The *Lokal-Anzeiger* says:

"No more shameless mockery of President Wilson's 'fourteen points' can be imagined than the proposed solution of the eastern question."—*N. Y. Times,* 16/4.

ITALY PRESSES FIUME ISSUE.—As early as March 21 it was reported that the Italian delegation had threatened to withdraw from the Peace Conference unless Fiume were assigned to Italy contemporaneously with the conclusion of peace. This threat may have had some influence upon the decision of the associated powers to incorporate the terms to all belligerents in a single treaty.

The Adriatic question was not finally taken up, however, until April 18-19, when Baron Sonnino, who signed the Treaty of London upon the fulfilment of which Italy insisted, presented the Italian claims. Following a decision of the Council of Premiers against Italy, the Italian delegates withdrew from the Peace Conference. President Wilson issued a statement justifying his position on the question.

LEAGUE OF NATIONS COVENANT COMPLETED

MONROE DOCTRINE AMENDMENT ADOPTED.—After long debate, and in response to insistent pressure from the United States, the following amendment recognizing the Monroe Doctrine was inserted in the League of Nations Covenant on April 10:

> Article X.—A—Nothing in this covenant shall be deemed to affect the validity of international engagements, such as treaties of arbitration or regional understandings like the Monroe Doctrine, for securing the maintenance of peace.

RACE EQUALITY AMENDMENT DEFEATED.—An amendment to the League Covenant presented by the Japanese members of the drafting committee, and providing recognition of the principle of racial equality, was defeated in the committee, 11 members voting in favor and 6 against it, whereas unanimous consent was required. The Japanese reserved the right to raise the question again in plenary sessions of the Conference.

GENEVA TO BE SEAT OF LEAGUE.—Geneva was selected as the permanent seat of the League of Nations by a vote of 12 to 6, France with two votes, and China, Czechoslovakia, Portugal, and Belgium voting in favor of Brussels. The choice was influenced by a speech from President Wilson favoring Geneva as more indubitably neutral than Brussels.

EX-KAISER TO BE PLACED ON TRIAL.—On April 9 the Council of Four came to the decision that the former Kaiser should be indicted and brought to trial on charges of violation of international morality and violation of the sanctity of treaties. These offenses were considered political rather than legal; and in the Responsibility Commission, which investigated the question, Secretary Lansing objected to prosecution on the ground that the charges would not bear legal scrutiny and that a sovereign could not be held legally responsible for his actions. The indictment signed by the four premiers provided for trial by a special court for violations of international morality.

INDEMNITY QUESTION SETTLED

The following Associated Press despatch gives a summary of the indemnity provisions decided upon by the Peace Conference. It will be noted that the sum mentioned, \$23,800,000,000, is a mininum, the indemnity commission having power to increase the amount "to the utmost of Germany's capacity to pay, within the limitation of her indebtedness." Some dissatisfaction was caused by the tentative allotment of the indemnity giving France about 55 per cent, Great Britain from 20 to 30 per cent, and only 25 to 15 per cent to the smaller Allied States. The press summary follows:

One hundred billion gold marks (\$23,800,000,000), is the amount Germany must pay the allied and associated governments for losses and damage caused in the war, plus other billions to be determined by a special commission on which Germany is to be represented. The payment of 100,000,000,000 gold marks is to be divided into three distinct amounts as follows:

First—Twenty billions within two years.

Second—Forty billions during thirty years beginning in 1921.

Third—Forty billions when a commission shall determine how it shall be done.

An authoritative statement was obtained to-day concerning the final terms of the settlements. This sums up the conditions as follows:

Germany is at the outset held generally responsible for losses and damages in accordance with President Wilson's fourteen points and the Allied response at the time the armistice was concluded. To determine the extent of the payment under this responsibility a commission is set up to take testimony, assemble data, and arrange all details of the payment from the enemy and distribution among the allied and associated powers.

While the commission will administer the details of the payments, sufficient is known to permit the determination that an initial payment will be required of 20,000,000,000 gold marks, payable in two years without interest. It has also been determined that 40,000,000,000 gold marks shall be payable in bonds extending over a period of thirty years, beginning in 1921, with a sinking fund beginning in 1926.

These 40,000,000,000 marks draw 2½ per cent interest from 1921 to 1926, and 5 per cent interest from 1926.

In addition to the foregoing payments, Germany will also be required to deliver additional bonds for 40,000,000,000 marks, when the commission determines that this shall be done. These three payments of twenty, forty, and forty billions bring the total to 100,000,000,000 gold marks.

Beyond this total, the commission is empowered to fix anything more that may be required to cover Germany's indebtedness.

" In other words," concluded the eminent American authority who framed the terms and furnished the foregoing summary, "a commission is set up with power to collect from Germany to the utmost of her capacity to pay, within the limitation of her indebtedness."

The allotment of the 100,000,000,000 marks among the allied and associated powers has not yet been finally decided, but a tentative arrangement makes the allotment of France about 55 per cent of the total, Great Britain's allotment between 20 and 30 per cent, and the allotment of the United States between 2 and 5 per cent.—*N. Y. Times*, 15/4.

DATE SET FOR GERMAN DELEGATES

On April 15 a formal invitation was issued by the Council of Four to the German Government to send its representatives to Versailles on April 25. It was stated that the German mission would probably number about 200 persons. The Paris *Temps* stated on April 16 that Germany would be allowed only until May 15 to decide whether or not she would sign the treaty.

FRANCE AND BRITAIN IN CLOSER AGREEMENT

It is learned that the new arrangement between France and Great Britain which some describe as a defensive alliance, is stronger than the old *entente cordiale* in that it contains a definite agreement on Great Britain's part to use her military forces in defence of France should the latter be attacked by an enemy.

The provision for the employment of military forces was not contained in the agreement itself, but in a separate note signed by Sir Edward (now Viscount) Grey, Secretary of State for Foreign Affairs—this note giving assurance that Great Britain would come to the assistance of France if necessary. A mere note, however, has no definite binding force, and the new undertaking on Great Britain's part is understood to be much more formal and final.

This arrangement between Great Britain and France is of interest in its bearing on the character of the undertaking sanctioned by President Wilson for American assistance to France in the event of German aggression.

How far the American assurances go is not yet disclosed, but the inference is drawn from the character of the British agreement that the President has met the French half way in their demand for special guarantees from Great Britain and America for the protection of the French frontiers from enemy attack.

American officials decline to say whether Mr. Wilson has actually given Premier Clemenceau a signed document containing assurances which, as has been stated in Paris despatches to *The New York Times*, engage the President of the United States to lay before Congress information of any enemy attack on France with the recommendation that such an attack be considered *a casus belli* by the United States.

French officials, however, continue to back up their statements that satisfactory guarantees have been given by President Wilson on behalf of the United States, and American officials have not withdrawn their admission that guarantees that satisfy French apprehensions have been furnished by the President.—*N. Y. Times*, 20/4.

say, her cross-section throughout the greater part of her length is rectangular, having only her bilge plates curved. Because of this, it was comparatively easy to erect the structure and to get her plates in position preliminary to welding. To hold them in place, *pro tem*, only a few bolt holes were needed; and after the lapped joints of the shell were welded the bolts were withdrawn, and the holes plugged with pins, which were, in their turn, sealed fast by the arc. The *Ac 1320* has met the stresses of service in an excellent manner and has had to contend with rough weather.

The hull plates of this novel vessel are lapped and the edges joggled, and this arrangement greatly aided horizontal downward welding. That is to say, the process of binding the contiguous surfaces together involved feeding molten steel into the upturned seam or lap. It was, in short, a sort of soldering process. Captain James Caldwell, of the Royal Engineers, has made it clear that there is a distinct economic gain to be realized in recourse to electric welding, but it is equally plain that the operator must be something of a specialist—probably more so than his corresponding rival who handles a rivet gun. This authority informs us:

"The operators were first-rate men, with extensive experience of electric welding in the shops and on structural work in shipyards. With the most difficult welding, such as vertical joints and overhead work, the quality of the welds was excellent. Quasi-arc electrodes were employed throughout, and for overhead work a special electrode was used. This proved well worth the slightly increased cost. All watertight joints up to and including the underside of the bilge plates were continuously welded both inside and outside, and the other watertight joints were welded continuously on one side and tack welded on the other. On the shell plating, the continuous welding was on the outside in all cases. For internal non-watertight joints and frame construction, tack welding was adopted sufficient to give a margin of strength over a similar riveted joint.

"Some interesting details are provided of the comparative cost of the electric welded and the riveted barges. In labor, 245-man hours were saved in constructing the welded barge. More than 1000 pounds of metal was saved by the substitution of welding for riveting, and even greater economy will result when the design is further modified to suit electric-welded ship construction. There were altogether 7000 lineal feet of welding on the barge, and over 3000 holes had to be filled up when service bolts were withdrawn. The total cost of welding was £301 ($1,459.85), comprising electrodes, £178 ($863.30); electric current, £61 ($295.85); and labor; £62 ($300.70). The cost of assembling similar barges in the same yard by the ordinary method of construction, including riveting, caulking, and drilling, was £389-8s ($1888.59), while in another yard, where ten barges were built, the average cost was £453-8s ($2198.99)."

When one realizes just how prime a part rivets play in the makeup of a modern steel ship, the value of electric welding becomes plain. In a cargo craft of 5500 tons deadweight capacity, for example, there are driven substantially 500,000 rivets, and in fabricating a 7500-ton freighter 650,000 rivets are needful to assemble and to bind together the various elements that make her a structural entity. A great many of these rivets, even with the aid of the pneumatic hammer, are driven under difficulties, and all too frequently a goodly percentage of the rivets in any vessel are found to be defective. This means that they must be cut out and driven anew. But this is by no means the whole story against the rivet.

Where plates are to be joined with angles or other plates corresponding holes must be bored in each contiguous surface, *i. e.*, at least two holes for every rivet, and in order to insure sufficient strength, lapping plates or butt straps may be double, treble, and even quadruple riveted. And what happens when these holes are not in line for the reception of the rivet? Where it is quite impossible by means of force applied in one way or another to bring the holes in alignment it is the custom to straighten out the passage by means of a reamer, and then to drive the rivet in a more or less

"The Entente Mission declared that it intends to regard the demarcation line as the political frontier. The aim of further occupation of the country is manifestly to make Hungary the jumping-off ground and the region of operations against the Russian Soviet army which is fighting on our frontier. The land evacuated by us, however, is to be the pay of the Czech troops, by means of whom the Russian Soviet army is to be overcome.

"As Provisional President of the Hungarian People's Republic, I turn as against the Paris Peace Conference to the proletariat of the world for justice and support."

WHAT IS LEFT OF HUNGARY

Austria, as it will be, is represented by the unshaded portion. The status of the other areas is as follows: Bohemia, Moravia, and Austrian Silesia will go to Czechoslovakia; Galicia is in dispute between the Poles and Ukrainians; Transylvania and the Bukowina will go to Rumania; the Banat is in dispute between the Jugoslavs and Rumanians; Croatia, Slavonia, Bosnia, and Herzegovina will be taken by the Jugoslavs; Dalmatia is in dispute between the Italians and Jugoslavs, but late cables say it will go to the latter on the understanding that Italy shall have Fiume; Istria probably will go to Italy with the Trentino; the Tyrol probably will go in part to Italy.—*N. Y. Times*, 30/3.

Without opposition, and apparently with the sanction of the former ruling powers, a "Revolutionary Government of Workers', Peasants', and Soldiers' Councils" at once took control in Hungary and issued a proclamation declaring "a dictatorship of the proletariat" and a policy of socialization of property and "armed alliance with the proletariat of Russia." Alexander Garbai became Premier or President of the New Government, and Bela Kun Foreign Minister.

From the very nature of things, it is desirable that overhead welding, *i. e.*, welding from the under side, should be held down to a minimum, and much of this can be avoided by doing this work while the parts to be joined in this manner are lying flat either in the shops or on the ground prior to setting up and assembling at the building slip.

Electric welding may be broadly divided into two methods: one is the arc-welding process and the other is the so-called "spot" and butt-welding process. Both of them are akin only so far as they have recourse to heat induced by the action of an electric current which serves to raise the temperature of the metals to be joined to a point where they will unite either by reason of added molten metal or by the application of pressure at the right moment. To prevent confusion it might be just as well to take up spot and butt-welding first, because this method is industrially the older one, although not so widely known or so generally practiced as arc welding.

Without going too much into details, the spot-welder apparatus consists of a suitable jaw or yoke equipped with copper electrodes between which are placed the pieces of metal which are to be heated and welded. A suitable current is then passed from electrode to electrode by way of the intervening material, which is held firmly together. The resistance to the flow of the current offered by this metal causes incandescence just as does the filament in an electric bulb, and when the steel, let us say, is glowing brightly the copper electrodes exert pressure and produce a weld at the point of contact, hence the term spot welding. This method of welding can be done by fairly unskilled labor, and satisfactory work can be effected rather rapidly. It will be realized that the union of the contiguous surfaces takes place only at each weld or spot, and, in this respect, is somewhat similar to the local binding action of rivets.

In butt welding, the pieces of metal placed between the jaws are set there so that the edges project somewhat beyond the electrodes, and because their surfaces are in contact, when heat and pressure are applied, the weld extends over the whole of the meeting surfaces and is, accordingly, a wider and stronger unit junction. In other words, it is virtually nothing more than amplified spot welding, and the same apparatus serves for both types of welds.

In arc welding much greater nicety of manipulation is required on the part of the operator, for success depends very largely upon his control of the heat induced by the arc, his maintenance of a fairly continuous arc, and the manner in which he fills in the deposited molten metal which constitutes the binding tie between the surfaces to be joined. Care, a cunning hand, and a sure eye are required even after the surfaces to be welded have been properly cleaned and otherwise made ready to be "soldered," so to speak. The electric arc, as most of us know, is the intense spark or flame produced by the current in spanning the air space between the electrodes of a broken or separated circuit. Now see how this phenomenon is applied to welding.

The materials to be welded are connected to one side, so to speak, of the electric circuit, and the electrode, which is directed by the operator, forms the other terminal. With the surfaces to be welded properly cleaned, the electrode is placed in contact, the current is turned on, and then the worker "strikes the arc" by slightly withdrawing the electrode which he holds. Instantly, the current jumps the gap which, depending upon the nature of the electrode, may range from 3/16 of an inch to 2 inches. The air space offers high resistance to the flow of the electricity, and this resistance promotes the generation of the intensely hot arc. For a satisfactory weld, it is essential that the worker should keep the electrode at a fairly uniform distance so that the arc will be steady and not a succession of discharges. Otherwise, the molten metal, instead of being deposited evenly, is laid in the form of "beads" of varying sizes, producing a spongy weld, and inviting oxidation. This objection applies especially to the use of the metallic electrode when manipulated unskilfully.

RIVAL GOVERNMENTS IN BAVARIA.—On April 7 the Revolutionary Central Council of Bavaria seized control of the government, proclaimed a Soviet Republic, and announced a provisional cabinet or list of "people's mandatories," including Dr. William Mühlon as Foreign Minister. Premier Hoffmann, who was in Berlin at the time when his government was overthrown, at once returned, established headquarters at Bamberg, and, with the recognition and support of the Ebert National Government, succeeded on April 12 in reestablishing temporary control in Munich.

During the week of April 20, however, the Bolshevists were again in control, virtual anarchy prevailing in Munich, and an army organized by the Hoffmann Government marching against the city. The peasants, who controlled the situation through possession of the food supply, were reported as still loyal to the Hoffmann Régime.

POLAND

RAIL ROUTE FOR TROOPS TO POLAND.—On March 26 General Nudant, representing Marshal Foch, presented a note to the German Government demanding a passage through the port of Danzig for the Polish divisions in France under General Haller which were to be sent to Poland. To this request the German Government objected on the grounds (1) that the armistice provided transit of Allied troops through Germany only for employment against Russia, and (2) that, as indicated during the journey of Premier Paderewski across German soil, the landing of Polish troops at Danzig would give rise to opposition beyond the German Government's control.

On April 4, Chairman Erzberger of the German Armistice Commission signed at Spa an agreement providing that the Polish troops should be transported to Warsaw by rail, on the condition, however, that should their passage provoke disturbances, the Allies would claim the right to land all troops at Danzig. This arrangement satisfied Germany and at the same time made possible a more rapid movement of troops. On April 15 the first contingent of the Polish Army started across Germany accompanied by Allied officers.

PADEREWSKI URGES CESSION OF DANZIG.—Premier Paderewski arrived in Paris on April 6, with the object of securing the cession of Danzig to Poland. According to unofficial reports, the Council of Four of the Peace Conference decided on April 18 to internationalize the port of Danzig. and give the Poles a "corridor" running from that city to their frontier.

FAR EAST

JAPAN'S TROUBLES IN KOREA.—The agitation for Korean independence, which began about March 1, has increased in seriousness. For the most part the revolutionary movement has been passive, the Koreans being without weapons or will for active resistance; but from all reports, the Japanese have resorted to severe measures in its suppression. Representatives of Korea in the United States issued in March a bill of grievances

reciting the oppressions of Japanese rule during the last ten years, such as enforced use of the Japanese language, compulsory sale of land, military espionage, and restrictions upon education.

A Peking despatch of April 12 stated that a Korean Provisional Government had been formed at Seoul.

CHINA URGES NULLIFICATION OF AGREEMENTS WITH JAPAN.—Nullification of the 21 demands made by Japan early in 1915 is urged by the Chinese Government in an official statement cabled from Peking and received here to-day.

The Peking statement declares that the Japanese treaties and notes forced upon China in 1915 should be abrogated "because their terms are incompatible with the principles upon which the League of Nations is founded." The statement is largely a reply to a recent statement made by Baron Makino of the Japanese delegation on the position of Japan.

"Since the Japanese delegate in Paris," the Chinese statement says, "has pointedly referred to the 21 demands, it is incumbent upon the Chinese Government to draw attention to the fact that China's acquiescence to terms subversive of her own interests were secured by means of an ultimatum to which she was forced to surrender because of the preoccupation of the rest of the world in the European war. It is a fact that the terms were imposed upon China at the point of the bayonet, the example followed being that of Prussia; the extension to 99 years of the lease of Port Arthur and South Manchurian railway concessions being precisely the German Shantung terms.

"In the subsequent agreement secured by Japan under the former Cabinet the principles followed have been equally dangerous, not only to China's liberty of action, but to her very independence."

The statement says that the claim of Japan to special privileges because the Japanese expelled the Germans from Shantung contrasts oddly with the failure of the Americans to claim the railways and mines of France, although the Germans were expelled from Alsace and Lorraine by the co-operation of the American Army. It says that the American Army of 2,000,000 lost more than 60 times the number of lives that Japan asserts she lost at Tsing-Tao. The statement also comments on the fact that England is not asking Belgium for a single concession, although Flanders "is one vast cemetery where English soldiers are buried."—*N. Y.* Times, 7/4.

RUSSIA

FOOD RELIEF FOR RUSSIA.—On April 16 an agreement was reached by the Associated Powers to send food to Russia under neutral supervision, though the French representatives raised some objections on the ground that this action might involve recognition of the Soviet Government.

The agreement stipulated that the Bolsheviki must cease hostilities. The relief work was put under a commission of Swiss and Scandinavians headed by Dr. Fridtjof Nansen, the Norwegian explorer. The distribution, it was suggested, should be handled by the Russians themselves.

ITALY

ADRIATIC BLOCKADE LIFTED.—The Italian delegation to-day notified the Peace Conference of the lifting of the military and commercial blockade in the Adriatic by which trading returns to conditions before the war, except that, until peace is declared, allied warships will have the right to search merchantmen.

The lifting of the blockade, in the light of complaints which have been made against it, is likely to relieve the food situation in Croatia and possibly further north, in Hungary, German Austria, and Bohemia.—*N. Y. Times*, 27/3.

TRADE REOPENED.—By decision of the military authorities of the Allied Governments, the Rhine has been opened for traffic with Switzerland, and shipments from the United States may now be forwarded to Switzerland by that route. The following countries and places with which, by reason of the blockade, trade was prohibited during the war, have since the signing of the armistice been opened for the resumption of trade by order of the War Trade Board: Siberia, Alsace-Lorraine, Palestine and Syria, Mesopotamia, Serbia and Rumania, the territory included in the line established by Article 3 of the military clause of the armistice protocol of November 3; Czecho-slovakia, Bulgaria, Turkey and Black Sea ports, the German colonies, the occupied territory of Germany, Adriatic ports, Albania and Montenegro, Luxemburg, the territory adjacent to and dependent upon the Adriatic ports, including Albania, Montenegro, Croatia, Slavonia, Bosnia, Herzegovina, and Dalmatia; Poland, Esthonia, and German Austria.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"Naval Power in the War." By Commander C. C. Gill, U. S. Navy. Price $1.50. (Published by George H. Doran Company, New York.)

Chapter I. The importance of naval power is shown. While admitting the great importance of naval power in the war, it is nevertheless believed that the author's statement, "Naval strategy was the grand strategy of the war," is an exaggeration. Except for strategy in its purely passive form, there was little real strategy in the war on the sea; Von Spee was really the only one who had an interesting strategical problem to solve. It is true that the naval blockade was possibly the one factor which—all the other factors being equal—gave the Allies the decision, but a decisive factor is not necessarily the most important factor. As an example, had there been unity of command in the Allied armies earlier, the war would in all probability have been decided before the blockade exerted its decisive influence.

Chapter II. Sea power, sea control and the plans of the opposing nations are discussed. Again the author claims that "naval power dominated the military situation."

Chapter III. The strengths of the opposing navies are accurately given. In the North Sea, the British had 33 vessels of the dreadnought type against 20 for the Germans. In the Mediterranean, France had four dreadnoughts and 18 pre-dreadnoughts against four dreadnoughts and six pre-dreadnoughts for Austria. The opening moves in the North Sea, the escape of the *Goeben* and *Breslau*, and the action between the *Emden* and *Sidney* are described.

Chapter IV. The action in Heligoland Bight is given in concise form and Vice Admiral Beatty's report quoted in full.

Chapter V. The salient features of the actions off Coronel and Falkland Islands are given. The author's criticism of Sturdee for sending the *Bristol*, which had three knots more speed than the German light cruisers, in chase of three merchantmen is very proper, but, as he notes, there may have been some good reason for this, and also, when a quick decision is necessary, it is easy for mistakes to be made, and, once made, it is often a greater disadvantage to make changes than to continue the original orders, even though they may not be the best possible.

Chapter VI. The description of the Dardanelles operation is clear and concise. It is one of the best in the book.

Chapters VII-VIII. A short description of the battle of the Dogger Bank is given. The battle of Jutland is described in more detail. It is, however, very difficult to describe such a complicated action without

publish reports on the subject in cooperation with the engineers of the research division of the Dayton Metal Products Co.—*Official Bulletin*, 3/19.

TELLS OF AUTOMATIC PLANE.—*Flew 100 Miles Without a Pilot Secretary Baker Reveals.*—Under automatic control, an airplane capable of carrying a heavy load and operated without a human guide, has made a trip of 100 miles and landed close to the point it set out to reach, Newton D. Baker, Secretary of War, disclosed in an address here to-day. Secretary Baker, with General Peyton C. March, Chief of Staff, came here to inspect Camp Bowie.

The device which made such a flight possible, and which has been kept secret, Mr. Baker said, is an automatic guide for airplanes, and was invented in America. It is designed as an instrument of war and the Secretary referred to it in describing to his audience the possible horrors of future wars if there is to be no League of Nations.

Secretary Baker did not explain the exact nature of the invention, but he made it clear that the War Department considered it one of the most wonderful pieces of mechanism for war's destructive purposes.—*N. Y. Times*, 3/25.

A remarkable long-distance flight over the North Sea, the longest non-stop oversea voyage of any British aircraft, has been performed by the non-rigid airship *NS-11*. The voyage, which took the form of a circuit embracing the coast of Denmark, Schleswig-Holstein, Heligoland, North Germany, and Holland, was characterized by extremely unfavorable weather conditions. The total length of the round trip was 1285 air miles, the time taken being 40½ hours.—*London Army and Navy Gazette*, 3/29.

BRITISH TRIPLANE CAN CARRY 100 PERSONS.—*Built to Travel Loaded 1200 Miles at More Than 80 Miles an Hour.*—The *Daily News* gives further particulars of the Tarrant super-triplane which Major Gen. Seely referred to in the House of Commons on March 13 and which is being assembled at the royal aircraft factory at Farnborough.

A striking feature is its long cigar-shaped fuselage, similar in appearance to the body of the Zeppelin machine. It was originally designed to bomb Berlin, carrying 10,000 pounds of bombs and a crew of eight over a distance of 1200 miles. It has a span of 141 feet, the fuselage is 85 feet and is fitted with six Napier Lion 506, engines.

When the aircraft industry began preparations for commercial flying the makers of the super-triplane followed suit, with the result that this type will be capable of carrying over 100 passengers, or cargo weighing nine tons, for a distance of 1200 miles. The speed of the converted machine will be anything from 80 to 100 miles per hour. It possesses enormous possibilities in continuous flying, and by extra tankage it would be possible to make a nonstop flight lasting 24 hours.

The fuselage is built of wood and strengthened by a patent system of girders not unlike the masts of an American warship, and this obviates the use of tracing wires and other fittings common to the ordinary airplane. There is freeway right down the center of the fuselage permitting anyone to walk to the tail. Three rows of glass windows, giving the appearance of portholes, will be fitted inside of the triplane, and tiers of seats will be provided for passengers.

In addition to the staff of pilots there will be on board two or three engineers and mechanics, a navigator, and a wireless operator.—*N. Y. Times*, 3/29.

WATERPROOFING AIRPLANE PROPELLERS WITH ALUMINUM LEAF.—A waterproof coating for airplane propellers, which incorporates thin aluminum leaf in the finish, was developed by the Forest Products Laboratory at Madison, Wis., and placed in production by the War Department. The

". . . . How I on the ice-cold sea passed the winter in exile,
In wretchedness, robbed of my kinsmen, with icicles hung.
The hail flew in showers about me; and there heard I only
The roar of the sea, ice-cold waves, and the song of the swan;
For pastime the gannets' cry served me; the kittiwakes' chatter
For laughter of men; and for mead-drink the call of the sea-mews. . . .
The shadows of night became darker, it snowed from the north.
The world was enchained by the frost; hail fell upon earth—
'Twas the coldest of grain. Yet the thoughts of my heart now are throbbing
To test the salt streams, the salt waves in tumultuous play.
Desire in my heart ever urges my spirit to wander,
To seek out the home of the stranger in lands afar off."

Another point apparent in the volume is the refusal of poets to recognize that for almost the last hundred years the great instrument in man's mastery of the ocean has been steam. The selections here are of course chiefly from the past; even so, is it not astonishing that in these 450 pages there are but two suggestions of the fact of modern motive power? One is from Masefield:

"Dirty British coaster with a salt-caked smokestack
Butting through the Channel in the mad March days."

The other is in one of the two selections from Kipling, who has seen clearly enough that machinery has not banished romance. Admiral Mahan has somewhere noted this poetic blindness or aversion, quoting as the single exception in his memory the following fine lines from Clough:

"Come back! Come back!
Back flies the foam; the hoisted flag streams back,
The long smoke wavers on the homeward track,
Back fly with winds things which the winds obey,
The strong ship follows her appointed way."

The passage just quoted has been overlooked in Lady Scott's collection. There are other possible mistakes of both exclusion and inclusion, needless to mention in criticism of a selection in general so well made for its purpose. But since there is prose as well as verse in the volume, space should surely have been found for something from the famous classic "Two Years Before the Mast." Of a passage in this the poet Rogers used to say that it had "more poetry in it than most modern verse." One is almost tempted to add that the book has more genuine sea poetry in it than there is in most so-called poetry of the sea. A. F. W.

"A Review of Studies in Map Reading and Field Sketching." By Lieut. Colonel Wilkinson J. Shaw, P. S. C., M. A. 8 vo., pp. 146. (Published by E. P. Dutton & Company, New York.)

This little volume will be of interest principally to those officers who are not practiced in outdoor sketching and who feel the necessity of "brushing up" in this subject in order to pass creditably an examination for

ITALIAN NAVY.—On Monday the Corriere d'Italia published the first complete list of losses sustained by the Italian Navy during the war. Altogether Italy has lost 54 units: 1 dreadnought, 2 battleships, 5 auxiliary battle cruisers, 8 destroyers, 5 torpedo-boats, 7 submarines, 9 submarine-chasers, and 17 miscellaneous ships, including minesweepers, tugboats, and supply ships. The Austrian Navy lost 45 units, including one dreadnought, 2 battleships, 2 torpedo-boats, 7 destroyers, 20 submarines, and 13 miscellaneous.—*Army and Navy Gazette*, 3/1.

The United States Government started condemnation proceedings in the federal court to determine the value of the Cape Cod Canal, which the government is to take over. The government bill which was filed by former Assistant United States District Attorney Francis H. Goodale. Condemnation proceedings were made necessary because the owners of the canal and the government representatives were unable to reach an agreement for purchase. An act of Congress authorizes the government to take over the property either by negotiation or condemnation. Papers filed by the government state that the title to the Canal is held by the Boston, Cape Cod and New York Canal Co., and that the Old Colony Trust Co. of Boston claims to be the owner and holder of the property under a mortgage. No date was set for the hearing.—*Shipping*, 4/5.

AMERICA'S RECORD SINCE ENTERING THE WAR TWO YEARS AGO

A Few of the Statistics Relating to Our Armed Forces, Casualties, Shipping, and Estimated Cost of Operations, April 6, 1917, to April 6, 1919

April 6, 1917—	
Regular Army	127,588
National Guard in Federal service	80,466
Reserve corps in service	4,000
Total of soldiers	212,034
Personnel of Navy	65,777
Marine Corps	15,627
Total armed forces	293,438
November 11, 1918—	
Army	3,764,000
Navy	497,030
Marine Corps	78,017
Total armed forces	4,339,047
Soldiers transported overseas	2,053,347
American troops in action, November 11, 1918	1,338,169
Soldiers in camps in the United States, November 11, 1918.	1,700,000
Casualties, Army and Marine Corps, A. E. F.	282,311
Death rate per thousand, A. E. F.	.057
German prisoners taken	44,000
Americans decorated by French, British, Belgian, and Italian armies, about	10,000
Number of men registered and classified under selective service law	23,700,000
Cost of thirty-two National Army cantonments and National Guard camps	$179,629,497
Students enrolled in 500 S. A. T. C. camps	170,000
Officers commissioned from training camps (exclusive of universities, etc.	80,000
Women engaged in Government war industries	2,000,000

The book is intended primarily for the operating engineer or prospective purchaser of stationery reciprocating steam engines, so will be found useful in any shore plant, but makes no attempt to enter the field of the marine or naval engineer. W. S. T.

"Koehler's West Point Manual of Disciplinary Physical Training." By Lieut. Colonel H. J. Koehler, U. S. Army. Price $2.00. (Published by Du Hon & Company.)

"Koehler's West Point Manual of Disciplinary Physical Training" is a well-written elementary treatise on physical training. The author has gone into his subject very carefully and has introduced some innovations. Mass commands have been used in training physical instructors, but Lieut. Colonel Koehler is a pioneer in adapting it for army use. It should be very valuable in training officers in the art of giving commands.

Lieut. Colonel Koehler's book, being in general a revision of Regulation No. 23, Field Training of The Soldier, now mandatory in army training, should be of much benefit to the country as a step toward standardized physical drill (along army lines) for colleges, preparatory schools, and lay institutions; hence, aiding universal preparedness. W. A. R.

The national matches have been staged at frequent intervals during the past decade, and are the means of determining the national rifle and pistol championships.

At the matches are usually in attendance 50 or more teams representing the services national guard and civilian organizations, colleges, military schools, and many hundreds of individual marksmen. This year, owing to rifle practice, 100 teams are expected to compete.

The policy of admitting civilian teams, one or more from each state, inaugurated in 1919 will prevail in the 1919 competitions. Particulars in regard to the admission of teams and other arrangements for the matches can be secured by addressing Executive Officer, National Matches, Room 1108, Woodward Building, Washington, D. C.—*Official Bulletin, 3/22.*

GERMANS TOOK 4765 U. S. MEN; 4376 REPORTED FREE, 233 DEAD.—The Statistics Branch, General Staff, War Department, issues the following:

Revision of prisoners records, which have been compiled from reports of prisoners from all sources, for the purpose of eliminating duplicate names, brings the total number of military prisoners taken to 4765. Of these 4376 have been reported released and 233 dead. The list of 156 names of prisoners whose status is still doubtful was forwarded on March 20 to the Central Records Office, A. E. F., for checking and investigation.

The record of army, marine, and civilian prisoners taken by the central powers as of March 20, is as follows:

	Army	Marine	Civilian
Taken prisoners	4,686	79	281
Died	229	4	...
Release recorded	4,304	72	116
Status doubtful	153	3	165

The following table shows by rank the number of military prisoners taken and the number reported dead:

	Taken prisoner	Died
Lieutenant colonel	1	...
Major	4	...
Captain	27	3
First lieutenant	262	29
Second lieutenant	101	17
Total officers	395	49
Enlisted men	4,370	184
Total	4,765	233

—*Official Bulletin, 3/26.*

A TIME-HONORED CUSTOM THREATENED.—According to the Portsmouth correspondent of the *Times*: there is some possibility of the time-honored custom of hoisting the Union flag at the peak and firing a gun on the occasion of a court-martial being abandoned. It seems that the practice has fallen into disuse during the war, owing to the majority of courts-martial being held on shore instead of afloat—to allow of which the Naval Discipline Act was amended in March, 1915. Formerly, courts could only be convened on board ship, and it may be recalled that a special act of Parliament was needed in George III's reign to enable the trial of Admiral Keppel to be held on shore by reason of the infirm state of the admiral's health. The last time the practice of hoisting the Union flag and firing a gun was carried out was when Admiral Troubridge was tried by court-martial at Portland in 1914. Merely because it is a pity that old customs should disappear we venture to protest against any decision being hastily

taken in this matter. It would be interesting to know when the practice of hoisting a flag to denote the venue of the court-martial was instituted and whether it was ordered or, like many other naval customs, was observed without being specially sanctioned by law. The *Manual of Naval Law* is silent on the point, although it does show that a custom as the laying of his sword *across* the table when the prisoner is an officer and *along* the table with its hilt towards him if acquitted, and *vice versa*, has long ago been embodied in the regulations.—*London Army and Navy Gazette*, 3/1.

PROPERTY OF OUR ARMY WILL BE SOLD TO FRANCE.—Docks, railroads, warehouses, hospitals, and barracks built by the American Expeditionary Force, to the value of $165,000,000, will be sold to France for the best figures the American Liquidation Commission can obtain. None of these can readily or profitably be removed, and the only alternative is to sell at the best bargain.

The Liquidation Commission is now negotiating for the disposal of various surplus properties belonging to the expeditionary force. Hundreds of thousands of uniforms have been dyed, so that they may now serve other armies, such as those of Belgium, Poland, and some of the Balkan States.

The present plan is to dispose of these surplus supplies among the governments which need them.—*N. Y. Times*, 3/19.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

WORLD'S WORK. **April.**—How Beatty Put to Sea, by *Lieut. Francis T. Hunter*, U. S. N. R.

CENTURY. **April.**—The Larger American Navy, by *Rear Admiral Charles J. Badger*, U. S. N. China's Case at the Peace Conference, by *Thomas F. Millard*.

SCIENTIFIC AMERICAN. **March 22.**—U. S. Navy 7-inch Caterpillar Mount, by *Commander H. Delano*, U. S. N.

March 29.—Radium and Radio-Activity, by *Charles H. Viol*. A 121-Mile Gun, by *J. Bernard Walker*.

April 5.—Hunting Submarines with a Sound Detector, by *Brewster S. Beach*. U. S. S. *New Mexico*, by *Henderson B. Gregory*.

April 12.—The New American Merchant Marine (I), by *Edward W. Hurley*. The Marine Diesel Oil Engine, by *John W. Anderson*. Salvage Work in New York Harbor. Is the Dirigible Outstripping the Airplane?

FLYING. **April.**—Who Will Be the First to Cross the Atlantic? by *Henry Woodhouse*. A Proposed Airplane Route Across the Atlantic, by *Prof. Wm. H. Hobbs*.

FRANKLIN INSTITUTE. **April.**—The Visibility of Airplanes (illus.), by *M. Luckeish*. The Color of Water, by *Wilder D. Bancroft*.

GREAT BRITAIN

EDINBURGH REVIEW. **January.**—Ships and Empire, by *David Hannay.*

NINETEENTH CENTURY AND AFTER. **March.**—Could the Fleet Have Forced the Straits? by *Major Gen. Sir Charles Callwell.*

QUARTERLY REVIEW. **January.**—The Freedom of the Seas, by *J. Pawly Bate.*

ENGINEERING. **March 21.**—The War Development of the Torpedo-Boat Destroyer (five pages of illustrations). Naval Engineers.

March 28.—H. M. Seaplane Carrying Ship *Argus* (illus.)

CONTINENTAL

RIVISTA GENERALE DE MARINA. **Spain.**—Movement of Floating Mines in the North Atlantic and Arctic, by the *Prince of Monaco.*

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, $3.00; enlisted men, U. S. Navy, $2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CUILIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

GREAT BRITAIN

BY-ELECTIONS AGAINST LLOYD GEORGE.—By-elections in West Leighton, which in December gave a coalitionist candidate a majority of 6000 over his Liberal opponent, resulted in the election of a Liberal by a majority of 2000. Central Hull in April also went Liberal for the first time since it became a parliamentary constituency. While these elections indicated a change of sentiment since December, they were interpreted in England as a vote for a "clean peace" and a "Wilson peace." Commander Hull, the victor in the Hull election, said that he interpreted it as a warning "that if the government and the Big Four in Paris could not make a just peace soon they must give way to persons who could, but if Lloyd George was standing by President Wilson and resisting Chanvinistic demands for an unclean peace of the old-fashioned sort, then Hull's vote would strengthen him very much."

PERSONAL AND PARLIAMENTARY TRIUMPH FOR LLOYD GEORGE.—During a flying visit to England, Premier Lloyd George, on April 16, answered his opponents in a vigorous speech in the House of Commons. Without revealing the terms of the Treaty, the premier declared that his pledges to the country would be embodied in the document. He bitterly attached Lord Northcliffe and his newspapers, creating apparently a permanent breach between himself and Northcliffe press. He declared that "complete understanding on the great fundamental peace questions" existed at the Conference. Referring to Russia, he denied that the question of recognition of the Bolsheviki had been even discussed, but added, "I would rather leave Russia Bolshevist until she sees her way out of it than to see Britain bankrupt." Munitions would be supplied to the opponents of the Bolsheviki, and forces would be organized in all allied countries "bordering on the Bolshevist territory, from the Baltic to the Black Sea—Poland, Czecho-slovakia, and Rumania." While the premier's speech was regarded as a parliamentary victory, it failed to silence opposition to his leadership.

QUIET RESTORED IN EGYPT.—An official statement issued at the headquarters of General Allenby, Special High Commissioner for Egypt and the Sudan, to-day, reads:

"Since noon yesterday quiet has prevailed throughout Egypt. An attempt on Thursday to tamper with a railway resulted in five arrests, while attempts to interfere with telegraphic communication resulted in the village of Beni Sembil being surrounded and given three days in which to produce the guilty persons. On Friday two rioters were killed and one was wounded when they were caught cutting telephone wires near Quesna."—*N. Y. Times*, 15/4.

SOVIET RULE IN HUNGARY

On March 22 Count Karolyi, Provisional President of the Hungarian People's Republic, resigned together with his Cabinet and turned the government over to Socialist-Communistic control. Upon resigning, Count Karolyi issued the following manifesto appealing to "the proletariat of the world" against the designs of the Allies in Hungary:

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United States Naval Institute Proceedings

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Entered at the Post Office at Annapolis, Maryland, as Second Class Matter

Vol. 45, No. 6 June, 1919 Whole No. 196

United States Naval Institute Proceedings

PUBLISHED MONTHLY
EDITED BY G. M. RAVENSCROFT

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

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Vol. 45, No. 6 June, 1919 Whole No. 196

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PUBLISHED MONTHLY
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U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

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UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. 45, No. 6 **JUNE, 1919** **Whole No. 196**

THE BATTLESHIP

By COMMANDER E. F. EGGERT, C. C., U. S. Navy

Military power, whether afloat or ashore, has in all ages been measured in units of skilled fighting men, properly equipped. Improved equipment increased the value of the unit, as is instanced by the success of the armored Greek, when opposed to the unarmored Asiatic.

Equipment was more or less permanent, could be captured, or passed on to new men; the men were but mortal; and, on the average, lack of men set limits to the power of the state.

From this fact arose the effort to increase, by constant improvement, in the equipment, the effectiveness of the fighting man at the front, and, as civilization developed, and the mechanical arts with it, the value of the unit of power was constantly augmented.

Equipment grew in effectiveness, and also in cost. In the Middle Ages equipment became so expensive that only a small part of the fighting men could be fitted out with the best equipment. Cost is a question of labor used in production, and a certain part of the man-power is required to furnish this labor.

Economy in money requires that we obtain as good equipment as is possible with the money available, for the numbers of fighting men we can count on. It must be here remembered that money means labor, and labor means time. It would be a simple matter to improve the equipment of the fleet, if there were no question of cost. No objection could be found to a complete

replacement of the battleship force by new ships of much greater size and power, if there were no loss of time, and no increase in the cost of maintenance. It is not necessary to argue that the men now on the old ships would have much greater fighting power on the new ships. But the millennium has not yet come, and there is the ever present spectre of cost.

When all is said and done, there is available a certain amount of money, to be expended in a given time, for fighting ships. Leaving out of consideration the small craft and auxiliaries, which consume but a small fraction of the total, the available funds will build, in a given time, a number of capital ships, the number depending on the type. What type shall be built? Clearly, the type or types that will give their crews, of a fixed number, the greatest fighting power. And why build capital ships? For the reason that the capital ships do give to a fixed number of men the greatest fighting power. Fighting power means offence *and* defence. It is just as necessary to protect our own men and material, as it is to damage or destroy the enemy's men and material.

The battleship has been developed into a machine that represents the greatest amount of fighting power that can be obtained from its crew. There is both offence and defence, balanced evenly. At different periods we will see battleships of different sizes, and different degrees of effectiveness, depending on the state of mechanical development at the time. But always there is the balance between offence and defence. A ship is no more a battleship, if she has no armor, than if she has no guns; if she has no torpedo protection than if she has no offence against torpedo vessels. The battleship has consistently represented the maximum fighting power for a given crew, which is the only thing that counts on the day of battle.

Many times have we seen special types evolved, even in capital ships. They have been brought about in most cases, perhaps in all, by ideas that might be traced to other bases than the fundamental one of fighting, and of producing fighting equipment. Already we have seen many of them disappear, after a short life, while the battleship type so far has remained. We need only mention the ram, the commerce destroying cruiser, the armored cruiser, the monitor. They all have wasted money that should have gone into fighting ships. We now have the battle cruiser,

that has grown until it is twice as expensive as a battleship of its date. Has it adequate fighting power against capital ships? There is but a limited offence and practically no defence. We shall perhaps see the battle cruiser go the way of the others.

We cannot tell who will be our enemies of the future. It takes a long time to build a fighting fleet, much longer than it takes to start a war. As long as we cannot predict whom we shall have to fight, and what forces we must have, we can only prepare on the basis of our own ultimate strength. We can tell how many skilled fighters we can obtain for the navy, and how many others must be reserved for the army. The number is large, the cost of equipment is large, and we cannot afford to waste any labor in building it—waste it on material that will not give our men an adequate amount of fighting power for the cost represented. That should always be the criterion. Do we get a proper return in fighting power for the expenditure?

What is fighting power in a battleship? First, it is represented by the destruction the ship can accomplish. Secondly, it is the defence it affords, from destruction, to its own crew. We must consider these separately.

The first, the offence, is nowadays easily measured. We no longer expect to lay alongside and board, or to ram, or perhaps even to torpedo, in a capital ship action. The power of offence in a battleship is measured by the number of effective hits she can make with her main battery, before her allowance of ammunition is expended. It is useless to make hits that glance off armor or decks, that make small holes in light upper works, or that do minor damage about the decks. It is only when serious damage is being done that the fighting power of the enemy is being crippled. Also, it is useless to rain projectiles about his ships, without hitting.

Let us now consider the defence. This has perhaps shown up better in the battles of the present war than has the offence. Battleships have been torpedoed in battle, and have remained in line. Ships have been exposed to heavy fire, such as, before the war, would have been considered fatal, and they have been heavily hit, but they went on fighting. But still, some of the ships, after receiving a few hits, were out of control, and some ships barely reached port. There is still much to be desired in the defence. There should be no lucky shots, a ship should

protection, such as the armored decks, and torpedo protection, so that the percentage given to fighting power is really considerably greater than the figures show. If now we take away some of the displacement used for motive power, what can we do with it? Evidently not much, since we could not take very much after all. The ship must have some motive power, and common sense will indicate without any figures at all that we could certainly not take away more than, say, half. Seven per cent of the total added to the forty or more already given to fighting power would not make any startling changes in the power of the battery, the thickness of the armor, or the amount of ammunition, especially as we would want to increase all of these factors at the same time. The loss in motive power represented by the seven per cent would reduce the radius of action to half, and the maximum speed from 21 to somewhere around 16 knots. It does not need any elaborate argument to show that the fighting power does not lose much if we retain the present speed and radius of action, and that there is therefore nothing to be gained by reducing these. The question now becomes, What do we lose when we attempt to increase radically the cost of motive power?

It might here be mentioned, though it should not be necessary, that minor changes from one design to the next, in the quantities referred to, are of no importance, provided they are not progressive. There is no absolute limit in either of the conflicting factors, and one or two per cent one way or the other need not be considered.

We must not, furthermore, take into account large quantities of fuel taken on board for a long voyage, which greatly increase the draft. It is never intended that these should be on board at the time of action, and it is only the weight on board in fighting trim that need be considered. We are not now concerned with any ill effects such extra weights might have on the habitability or seaworthiness of the vessel.

If, now, we should double the allowance given to motive power, we see that the effect on fighting power, if we retain the same total cost, is as great as the effect on the motive power was in the previous instance. The allowance is cut from 40 per cent to 25 per cent, and the effect on each of the quantities included in the general term, fighting power, is serious. We would have

left only about 60 per cent of the previous quantities; thus, the armor would have to be reduced from thirteen to eight inches in thickness, the battery from twelve guns to eight, and the other factors in proportion. Clearly, the effect is not a happy one from the point of view of fighting power. To offset this, we have only increased the maximum speed from 21 to 23 knots, and added a little to the radius of action, hardly a compensating advantage.

In our latest battleships we have increased the speed from 21 to 23 knots. If we had retained the size previously standard, the above would have represented the result. It has been necessary to increase the size and cost of the vessel to obtain this increased speed. Of course there were other increases made, principally in the battery power, but we paid for the increased speed just the same. The size of the vessel was increased over thirty per cent, or by an amount equivalent to nearly the whole of the fighting power of the previous smaller vessel. That the number of guns in the main battery was increased fifty per cent does not imply that the fighting power has been correspondingly increased. The size of the target has been increased, or in other words the ability, and therefore the certainty, of the enemy to increase the number of his effective hits; the efficiency of the three-gun turrets is probably less at medium ranges, from the ballistic standpoint; and we might question whether after all the fighting power has been much increased.

It is to be expected that the size of battleships will increase and continue to increase, and we might expect with each increase of size a small increase of speed, and perhaps of normal radius, but it is natural to assume that the country will expect also a corresponding increase in the fighting power of the larger craft. There is no future limit to the size of the type, nor to the ultimate speed that will be attained, but the country must pay for the total navy finally built, and has a right to expect proper fighting efficiency.

If the above has been the effect of doubling the cost of the motive power, what shall we say of the latest proposition, the so-called fast battleship? Here we have motive power comparable to that of our proposed battle-cruisers, and fighting power distinctly inferior to that of the last class of battleships, the 21-knot ships. The displacement is nearly doubled, and the cost,

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A battleship should not be longer than necessary, and we should even be prepared to accept some reduction in the efficiency of propulsion, to get a shorter ship. Great length means heavy hull, extra armor and decks, greater target, higher center of gravity, and wetter decks in a head sea. It also requires more weight for torpedo protection. The present tendency, due to the canal limitations, is to increase displacement by increasing length. This has the effect of reducing fighting efficiency.

Metacentric height has an important effect on the efficiency of the ship. There should be enough to prevent great heel when firing a salvo, or turning at speed, but not so much as unduly to cut down the period of rolling. A short rolling period always means much rolling. If a period of about twenty seconds for a complete roll could be obtained, rolling would be almost eliminated, except in the severest weather. Metacentric height is also a factor in the range of stability.

Coming now to the factors more directly concerned in fighting, we will start with torpedo protection. A battleship should be so protected that she can stand a torpedo explosion in any part of the hull without disablement. There is no present difficulty, with our present type, in nearly accomplishing this, and the ship will stand torpedoing several times, in different locations, without great loss of fighting efficiency. The only important parts that cannot now be protected are the rudder, propellers, and shafting, and a hit in their vicinity may mean loss of motive power. It might be possible to improve this situation by a different design of hull, but probably with a loss of propelling efficiency, and whether it is worth while is open to question. There is no doubt, however, that torpedo protection should be thoroughly carried out, and large size is for this object a distinct advantage.

Considering now the armor protection, we can establish it at once as a fact that if the vessel is intended to fight only at long range, as seems to be a favorite idea, there is no need for the side armor, since it becomes a vanishingly small part of the target. This is, however, far from the actual fact. The vessel may have to do some fighting at long range, but how much of her scanty allowance of ammunition can she afford to throw away at long range? Remember that when her ammunition is gone her fighting power disappears.

History shows that never yet has a decisive action been fought between nearly equal forces at long range, and the term is here used in a relative sense, each period having its own definition of long range. The reason for fighting a decisive battle at close range is not hard to find. The offence is a matter of how many effective hits can be made. Therefore we may expect the same thing to come to pass. Why should we attempt to decide a battle at long range? Cannot much greater damage be done at short range? Of course we will suffer ourselves, but we cannot expect to fight without receiving damage. A successful fighter always takes punishment, and is able to withstand it better than his opponent. That is the whole thing in a nutshell.

The battleship must therefore be designed primarily to fight at short range, and secondarily at long range. High spotting stations, kite balloons, elaborate fire control instruments, are all good in their way, and probably useful, and should be developed. The ship may need them at long range. But these things will all be swept away when we come to the really serious part of the fighting. Then we will want thick armor, powerful guns, simple and rugged turret machinery, and plenty of ammunition.

Our ships are not now armored in such a way that they can stand up for a long time at short range. They may do very well at 12,000 yards, but that is not short range. The range can be considered short when say more than fifty per cent of hits can be made, by the average ship. It will also be necessary to be somewhat independent of range-finders and range keeping. These things we cannot expect to survive in a decisive battle. Perhaps we might, for the present, define short range as 5000 yards. If, at this distance, our ships were fighting broadside to broadside, or, as they used to say, yardarm to yardarm, the fifty per cent of hits would probably all be effective, and the damage would be great. We should fit armor that will prevent this.

Inclined armor will go a long way to accomplish this. This is not a new idea. It was used in the *Merrimac* of the sixties. It is used now in our turret fronts. We can incline all our side armor inward at say 45 degrees, and it would be proof at very short range against the heaviest modern projectile, if of the thicknesses now used. It is a delicate problem in stability for the naval architect, but it can be done.

Our barbettes will need greater thickness than they have at present, and should be made considerably heavier. It might be possible to compensate somewhat for this by reducing their heights. This will be touched on later.

Protective decks, of the thickness we now use, are good enough at short range, but as the ship must be exposed to gun fire at long range, provision should be made for it. There is no way of escaping serious damage at long range, if the enemy obtains hits. If the protective deck were made narrower, as a result of inclining the side armor inward, we could afford to make it thicker, but not otherwise. The decks now are so heavy, and their effect on stability so marked, that we could hardly afford to put any more weight into them. The protective plating on our decks now amounts to about 10 per cent of the displacement.

The secondary battery is intended only for protection against torpedo craft. Yet we see a great number of men on our battleships that are used only to man these small guns. The number is quite comparable to that used for the main battery. This does not seem logical. If so many fighting men are really necessary for an object that is quite secondary, the natural inference is that the existence of the type is rather precarious. There is need for depending more on passive torpedo protection, just as against gun fire we depend more on passive armor protection, and less on "a well-directed fire from our own guns." That this is quite logical is indicated by the fact that in our latest ships the torpedo protection is quite as efficient against torpedoes as the armor is against heavy projectiles. A weapon of destruction is intended for the offensive, and not primarily for the defensive. There is of course no objection to smashing a destroyer if we get a chance, though, as has been said before, it is cheaper to have smaller types to look out for that. The secondary battery and its crews should be much reduced.

It is hardly necessary to mention torpedo outfits. It is coming more and more to be recognized that these have no place on a battleship, and the outfits we now fit are considerably reduced from what we at one time fitted. It is to be hoped that at a date not very distant they will be entirely eliminated.

Now, last of all, we come to a consideration of the main battery, the primary weapon of the battleship. There has been so much argument about this matter as to leave us entirely con-

fused; there have been so many different arrangements, numbers, and types, that it is quite certain no logic has governed.

The British have come to the belief that not more than eight heavy guns should be mounted on one ship, but they have been building moderate sized ships, and for a special field of action. It is doubtful whether we could take their example for our own guidance, especially when we build larger ships.

We all have a feeling, which is founded on subconscious conviction, as we have not yet been able to justify it by logic, that a larger ship should have a greater battery; in fact, that we are not warranted in building a larger ship unless we increase the battery in proportion. We can easily justify this idea on the basis of economy. There should certainly be at least a standard percentage, for the offensive, in every ton of displacement, and progress in development would seem to call for an ever increasing percentage. Should not every successive phase in development increase the fighting power of the men on board? Hence the distrust with which we regard a design which doubles the displacement, for purposes of speed, and leaves the battery without such increase.

We may therefore feel justified if, on our larger displacements, we carry a heavier battery than the British have placed on their standard battleships. The difficulty is, however, in making proper use of the larger weight. Shall we use larger caliber guns, or more guns, or longer and more powerful guns?

We have mounted up to six turrets on one ship, and have lost some of our fear of interference between the different turrets. A large number of turrets requires, however, a heavy weight of armor for the individual barbettes, and more is used up in the turrets than if we used fewer turrets with a greater number of guns per turret. The need for a greater amount of armor protection on our ships, so as to enable them to fight at closer range, may force our hand in this respect, and compel the adoption or retention of multiple gun turrets, much as we might prefer not to do so, for reasons of putting all our eggs in one basket. This latter point becomes more serious at short range, and will require more careful consideration.

There would be a certain amount of armor weight available for turrets and barbettes. If we used this weight for two-gun turrets, we would have thinner armor than if we used it for three-

gun turrets, and the difference would be greater still for four-gun turrets. It might be said that the turret fronts are now impenetrable, and need no further weight, even if larger guns were used. That is not the case with the barbettes, and it is these that consume so much weight. The fewer the gun stations, the less the weight of the barbettes for a given thickness.

In a two-gun turret, we expose two guns and their crews to destruction from one penetrating projectile. It has been said that with a three-gun turret we expose three guns instead of two. That is true, as far as it goes, but in this case we can have a thicker port plate, and thicker barbette plating, and so prevent penetration. In the case of a four-gun turret, this advantage is even more pronounced, and in addition we can still further protect the turret by fitting a thick plate between the two pairs of guns, an arrangement that is feasible in this case, but not in the three-gun arrangement.

As far as the strength of the hull is concerned, we need have no fear, on account of a four-gun battery, since the stresses will not be greater than with the two-gun arrangement, if each four-gun turret takes the place of two adjacent two-gun turrets.

It seems therefore to be sound judgment not to go back to the two-gun arrangement, and, further, to go to the four-gun turret as soon as practicable. It would, however, be wise to enlarge the turrets to give the individual guns more room, and to prevent jamming of adjacent guns by a single hit. This would also somewhat reduce the interference between adjacent guns, and improve the ballistics at medium ranges. This can be done, and the power of resistance of the barbette greatly increased, by making it conical, the top diameter being the greater, and the inclination of the elements about 15 degrees.

As regards height of battery above water, we have adopted definite heights for Numbers I and IV turrets. From the point of view of weather and sea, there is no reason why we should use greater heights for the other two turrets in our later ships. This present arrangement, the vertical echelon, has been dictated by two considerations; one is the more compact arrangement, permitting placing the whole battery in a shorter length, the other is the desire for end-on fire. If we retain four turrets, in a larger ship, there should be no difficulty as regards the first consideration. As regards the other, is end-on fire really so impor-

tant? We pay for it heavily in this case; it has been costing us over 500 tons, in heavier barbettes and foundations.

It is no doubt a time-honored arrangement, to get as much end-on fire as possible, and conservatism would dictate retaining it. It arose in the days when fighting at very short ranges was contemplated, when three thousand yards constituted long battle range, when ramming was still finding advocates. This was also the day of the powerful turret turning gear, which permitted swinging very swiftly from side to side, to keep on the target in spite of the quick turn in manœuvering to ram, or to strike an enemy alternately starboard and port. It hardly accords with our present-day ideas of fire control and fighting. There is no doubt that most, if not all, of the fire in action will be on the broadside, and that the vertical echelon arrangement is unnecessary.

The indications are then that we should employ an arrangement of multiple gun turrets, as far as possible on the same level, the forward turrets perhaps being higher than the after turrets. This arrangement will incidentally be quite a help in getting satisfactory stability, as it will not raise the center of gravity so much.

When we have reached the limit of four four-gun turrets, the question again presents itself, how to take care of a still further increase in the main battery. We have now adopted the 16-inch gun. Shall we go to still larger calibers? Undoubtedly we shall. An additional four-gun turret would require a much greater increase in length, which is very undesirable. We would hardly be prepared to put five or six guns in one turret. We can then obtain the increase in battery power only by increasing the caliber, or by increasing the length of the guns, and the latter method has much closer limitations than the former.

Here it would be well to observe that from many points of view it would be better to increase the length and the initial velocity of the guns, rather than to increase the caliber. Thus, penetration of armor is obtained more easily with a small than with a large diameter of projectile, of the same striking energy. A little manipulation of the penetration formulæ shows that the thickness penetrated is proportional to the $\frac{2}{3}$ power of the striking energy divided by the caliber. Therefore, the larger the caliber, for a given energy, the less the penetration. There is

then as much penetration to be obtained with the 14-inch projectile as with the 16-inch, if the striking velocities are in the proportion of 3200 to 2600. Again, the greater velocity will give the required ranges with a flatter trajectory, and thus, at comparatively short ranges, will increase the chance of hitting.

A little consideration will show, however, that although this is all true theoretically, the differences from the customary practice must be rather extreme, in order to obtain reasonable increases in the qualities named. It would not be enough advantage to make it worth while, if the velocity were increased from 2600 to 2800. The difference in the angle of fall would be too slight to make much difference, and the difference in penetration also would hardly compensate for the cost. If, now, we could get a velocity of 3500 to 4000, the effect would be well worth while. This must, however, wait further developments, as we do not want guns that would have an accuracy life of only about fifty rounds. It therefore seems that the larger calibers must come, since that is the only feasible way to increase battery power.

In conclusion, it must again be emphasized that we want fighting power above everything else on our battleships. We want our ton of fighting power for every two tons of displacement. The crews that will fight our battleships in the great deciding battles of the future will need to strike hard, and they will need to survive effective until the work is done. Fighting power is composed of but two things, *offence and defence.*

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NAVAL RESEARCH

By Commander C. S. McDowell, U. S. Navy

When the Armistice went into effect at 11.00 a. m. November 11, 1918, the whole world was thrown out of adjustment or synchronism. Taking this time as a point of departure, it is necessary for the navy and the world in general to readjust itself to new ideas and new missions. We all believe that the war has not been in vain, but, to make this assumption true, it is necessary that we carefully consider the lessons of the war and profit by them in our plans for the future.

Previous to the war the navy had been gradually developing the policy of closer co-operation with civilian engineering activities, as may be evidenced by its representation on standards committees of various engineering societies, and by its calling on engineering societies and recognized civilian experts along certain lines for help in the solution of special problems. In particular the forming of the Naval Consulting Board may be cited as a recognition, by the navy, of the desirability of having the scientific engineering talent of the country available for consultation and advice where its services were required.

We need not necessarily consider the navy as conservative in only of late adopting such a policy, for it is one which has only lately come to the front in civil life. Formerly in the commercial field the utmost secrecy prevailed as to the research work undertaken, and shop practices employed, by the different companies. It has been found, however, that there is sufficient opportunity for all, and that the advantages of competition and emulation are but accentuated by the bringing of independent interests in close touch with one another under conditions such that their combined experiences and deductions may be co-related, with the result that standard rules and practices may be expressed.

The war has brought out, or at least hastened the development of, an enlightened policy between the Government and the various organizations of the country, and between nations as well, which may be considered an innovation. It consists of the pooling of experiences and opinions, without reservation, and the active co-operation of all concerned.

The world may be considered at present as in a nascent state; new plans can be put in actual practice now without the overcoming of inertia of settled conditions such as will exist within a few months. The immediate future, then, should be considered as the days of golden opportunity in applying the lessons of the war, rather than as a time of reaction and inactivity.

It is my idea, in this article, to present the needs of Naval Research and to show that now is the time to formulate a definite policy and make definite plans for such research, including a continuation of much of the work of this nature which was started during the days of the war under emergency conditions. Very few of the ideas here presented are original, but serious consideration of them by the navy at this time is of great importance to the future of the navy and the country.

To show that there is nothing new in the statement that Naval Research is necessary in order that there should be proper progress in the navy, the following extracts from a paper written by Admiral Melville in 1902 are quoted:

> The success of Germany can be accounted for only by recognizing the fact that study, reflection, and *research* must have been expended in the preparation of plans, in the building up and the organization of the shipyards, and in laying out and carrying on the work of construction. It was the high appreciation of the value of *original investigation*, coupled with experimental work, that has caused Germany to advance progressively and successfully.
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> For over a hundred years Germany, as a nation, has carried on more *original* research along technical lines than any other power. While it is true that both England and America have put to practical application the principles discovered by German research, thereby gaining commercial and maritime advantages, it has been the Teuton who has sought after principles.
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> The cost of maintaining a battleship in commission will approximate \$1000 per day, and warships have been tied up for weeks on account of the corrosion of a few hundred dollars' worth of boiler tubes. It will repay the nation for the cost of an experimental station if the staff of the

laboratory will simply cause increased length of life of both boiler and condenser tubes.

It is methodical, thoughtful, and persistent work which counts, and as the Germans exceed in this respect, the engineering world is now beginning to understand in its fullness the value of the work done at the German engineering laboratories in promoting German success in both naval construction and maritime development.

It is an anomaly that the greatest of military nations should be the first to appreciate the scientific attainments and capabilities of the engineer, and it is for this reason that Germany has a start of at least five years over England, France and America in systematic naval engineering research. In all probability each of the three other nations has spent more money than Germany in experimental work, but German expenditure, in great part, has taken place before the article is manufactured or the ship is laid down, while in the case of some rival powers, tests and experiments have been conducted to discover means of overcoming avoidable defects.

The proverbs that "an ounce of prevention is worth a pound of cure" and that "a stitch in time saves nine" are as applicable to-day as they were in the last century. It is for this reason that the preparatory experimental work conducted by Germany has been productive of greater results than that done by rival powers working in the direction of seeking remedies for existing evils.

The cost to the British Government of using the cruisers *Hyacinth*, *Minerva*, and *Hermes* for comparative boiler tests and experiments will approximate more than the cost of establishing and operating both the Charlottenburg and the Dresden stations since their inception.

Experience has shown that the German engineering laboratories are more than a good paying investment, for there is not an expert in that empire familiar with the work being done at these laboratories who does not believe that their destruction would be a greater national calamity to the navy and the nation than the loss of one of the battleships of the home squadron. The warship could be replaced in four years. It would take six years to rebuild and put in effective operation the complete installation for conducting experimental research that has been developed and perfected at the Charlottenburg and Dresden technical colleges.

It can be absolutely stated that the navy is behind the times in original work and research—one of the marine superintendents of one of the Great Lake transportation companies told me that if he were called upon to retrench in expenditures the last item to be cut down would be that for experimental purposes, since both the cost of construction and the expense of operation of the steamers under his control had been reduced as a result of the data secured from experimental work. There is not a leading university, large manufacturing concern, or great transportation company that does not consider it imperative to make tests and experiments. Every navy will also find that it will increase efficiency and promote economy to conduct and to encourage extended investigation of unsolved problems relating to its marine service.

if the vessel is ever built, will be more than doubled. The result must necessarily be that in the long run, in a given term of years, the fighting power of the entire fleet must suffer. And what would we gain by it? Merely that these vessels, in some circumstances, might run at a higher speed than the rest of the fleet. The offensive power is not greater than that of contemporaries of slower speed, it is measured by the allowance of ammunition, and the use that is made of it. Would this vessel, if she dashes here and there at high speed, making a few hits here and a few there, do a greater sum total of damage than if she settled down to fight an opponent in the old-fashioned way? After all, we are not concerned with an indecisive battle, where there is a little damage done, and a ship sunk here and there. We must consider a battle that will settle, once for all, for that war, the mastery of the seas. For the money that we spend on these vessels, the enemy can put more than twice the fighting power afloat, and where then is our mastery of the seas?

Neither can we consider the possibility of shaking the enemy's morale, by concentrating fast ships on detached portions of his line and destroying them. In the first place, we must expect to meet an enemy as determined as ourselves, and not to be shaken by small losses. In the second place, we can expect him to be equally skillful, and not to leave a few units unsupported. Again, concentration can be of value only at short range, for at long range small differences of distance disappear, and concentration of fire on one ship means that other ships will not get the proper amount of attention. Can we imagine these vessels, lightly armored, and immense targets, coming to close quarters with standard battleships?

In all this discussion, we deal with equal forces on both sides. If we were greatly superior to our opponent, the exact type of ship would be unimportant. If we were much inferior, we would have no chance anyway. The assumption of equal forces appears reasonable. Even if we were slightly superior, we could not give hostages to fortune by wasting fighting power.

If the high speed battleship does not seem a reasonable proposition in a general battle, then why the high speed? As we have said before, we would not expect a battleship to chase small craft. We do not use a sledge hammer to smash a fly. It is too slow, and takes too much effort. We get a swatter, a light, quick, cheap

on research. If, on the other hand, we are to take a leading part in naval and maritime matters, we must have some definite plan of procedure so that the present needs of the service may be taken care of, and the new scientific discoveries be applied to improving the efficiency of the service.

It has been said that not one in a thousand of the many inventions and suggestions submitted to the government during the war by outside parties was worthy of any consideration, and that not one in a hundred of those worthy of consideration were in form for adoption without considerable research and experimental work. It is believed that the above statement is if anything optimistic. The new principles, apparatus and devices which were developed and used in the war were the result of careful and diligent investigation and experiment by persons devoting their whole time and purposes to new problems, and with which they had to be more or less familiar. Experience has been in clear contradiction of the rather universal idea of the country that we simply have to express a need for some new device or apparatus and the American genius will arise with the answer. Natural talents are of little avail, but, with orderly training and opportunity for expansion of intellect, such talents become of great value.

Although the testing of untried and doubtful devices that may be brought to its attention is a function of the navy's research and experimental work, this should not be considered as the major work of the research organization. It is necessary if our navy is really to be efficient, that it should originate new developments and keep ahead of the times. In other words, it should be a leader, rather than simply following the lead of others and simply testing out ideas which may be presented to it.

There was an enthusiastic response from the scientists and engineers of the country to the navy's request for assistance in solving the problems suddenly thrust upon it by the declaration of the war and the realization of the fact that many things had to be accomplished in a hurry if the war was to be successfully pursued. These men before they could intelligently undertake their work had to become familiar with the service needs and service conditions and become indoctrinated. This was accomplished in the case of a great number of these, but much time was lost and work was carried out at much greater expense

that time and be replaced by other scientists. The navy, by this plan, would be kept in touch with outside researches and developments and the civilian scientists would be kept in touch with, and interested in, the navy and its problems.

The question may naturally arise as to the possibility of doing much of the naval research work in outside laboratories, or at the Bureau of Standards. It is considered that this is impossible and that the navy must have its own research organization and its own laboratories and application stations. Naval research must be directed and carried out by personnel intimately familiar with the naval problems and service conditions. The writer put the question to the scientific director of the British Admiralty as to the advisability of utilizing the British National Physical Laboratory for the pure research work of the Admiralty rather than establish a separate Admiralty Pure Research Laboratory in London. It was found that the British idea was the same as expressed above: that naval research must be directly under naval control and that the personnel directing and conducting such research should be thoroughly familiar with the naval problems and conditions.

It is hardly necessary, or indeed possible, to give at this time a list of naval problems which require research and experimentation. Also, needs will develop as researches are carried out, which cannot now even be given names. However, to show the scope of the work which it is considered should be covered by naval research, the following partial list of desirable problems may be stated:

Bearings and Lubricants,
Diesel Engines,
Electric Arc Welding,
Erosion (guns, turbines, etc.),
Fire Control,
Light and Illumination (including searchlights),
Optics (range finders and periscopes),
Powdered Fuel,
Radio,
Sound (including the use of underwater sounds for navigation purposes),
Steel Alloys,
Turbines.

It will be noted that, while some of these problems may be considered as purely military, the majority of them have wide application to the merchant marine and to the country in general.

The advantages which have accrued to the navy, as a result of preliminary research on two of the above subjects, are cited:

1. *Electric Welding for Marine Work.*—An investigation of the use of electric welding for navy work was carried out at the New York Navy Yard in 1914 and 1915, and the navy was ready to use this method for repairing of the ex-German ships when they were taken over by the United States, with the result that these vessels were ready for service much earlier than they could otherwise have been. The value of this knowledge of the possibilities of electric welding for repair work was probably worth more to the navy than has ever been spent by the navy on research.

During the war considerable research on electric welding has been carried out and much has been learned. There remains, however, much to be learned on this subject, and it appears desirable for the navy to carry out further research on this problem.

2. *Searchlights.*—The navy has for a number of years been carrying on investigations and researches on searchlights. There is no particular reason for commercial companies carrying out research on this problem as long as they have a satisfactory commercial product. The improvements in searchlights of the present time over those of a few years ago have really been forced by the navy. This is as it should be, for the navy is the user of this apparatus and is the party directly interested in having the most efficient obtainable. It may be noted that the British services maintained during the war a searchlight laboratory in London which was directed by a searchlight council made up of representative officers of the navy, army and air service. There were officers on this council from the Admiralty, the war office, the air office, from the forces in France, the fleet, H. M. S. *Vernon,* etc., and all questions of experiments, types of apparatus, and quantities to be manufactured, and allocation of finished apparatus, were decided by this council. The writer attended a meeting of this council and was very favorably impressed with the manner of carrying on

this work and the co-operation which obtained between the various services and interests involved. There are at present, however, fundamental facts in regard to military searchlights which remain to be investigated. Undoubtedly careful research will produce a much more satisfactory apparatus than we now possess.

In research, applying this term in its broad sense and including both theoretical and applied investigations into the matter, there are two general types of problems with all gradations between:

(a) The problem of a pure research type, exploratory and fundamental in character, and involving work of a high order in physics, chemistry, mathematics, etc.

(b) The problem of industrial development and application, involving thorough engineering, design and manufacturing ability, and experience of the service conditions to which the apparatus or material will be subjected.

The man who is interested in the problem of a pure research type, and is most competent for work of this character, is not generally interested in its engineering application, except indirectly, and for efficient work should not be burdened by consideration of that side of the question, except as necessary for effective direction of his own work as a whole. This man should, however, be familiar with the navy service conditions so that he may realize the difficulties and restrictions imposed by service conditions. He is generally not competent in the applied side of the problem and any attention given by him to that work, except as necessary to better understand his own part of the problem, is inefficient. On the other hand, the engineer who is competent in design, development and production, to meet service conditions and service needs, is generally not especially interested, nor competent, in the pure research side of the problem. To properly carry out his work, however, he must have a general understanding and appreciation of such pure research work, in order to secure effective co-operation.

At the naval experimental station, New London, Conn., the demarcation, as given above, between the two divisions of research and development work, has been generally followed, with, however, a liberal interlocking of the two divisions. The experience of this station tends to show that this organization is cor-

rect and satisfactory. It is believed that those industrial-engineering organizations that have recognized the above situation and have developed two groups of men in their research-development divisions, with close contact between the two groups, have secured the most effective organization, and that their experience under the emergency conditions of war has proved this system to be most satisfactory. Substantially this is the form of organization of the General Electric Company, the Westinghouse Electric & Manufacturing Company, and the Western Electric Company, as well as others.

It is believed that the navy should organize two such groups of men to handle its research and development problems, these two groups, while distinct, being in as close contact as possible with each other. It is probable that the majority of the arguments would favor the creation of a centralized laboratory and staff in the vicinity of Washington, devoted to the pure research work and the development of such apparatus as does not require sea experimentation or trials with various types of craft, and the maintaining of such other stations, as the naval experimental station, New London, as may be necessary for the applied engineering development and manufacture of material and apparatus in small quantities until the type has proved satisfactory and can be turned over to manufacturers for quantity production. The groups on the applied development work should be located where local advantageous conditions dictate, but it will, of course, be most effective to bring as many of these groups together in a given location, and to maintain as few stations for such work as possible. It may be pointed out that this suggested plan is quite similar to that of the Department of Agriculture, with its centralized laboratory and staff in Washington, and its distributed experimental stations in each state for study and application under the local conditions of soil and climate.

As previously stated, the personnel side of research work is considered of greater importance than the mere providing of laboratory buildings and facilities, although these latter are, of course, very necessary. It is desired to emphasize, though, the fact that the mere creation of buildings and equipment will not in itself provide the effective research which the navy requires.

As the head of the navy's research organization there should be provided a director of research, probably under operations, and associated with him a research council. This council to be made up of representatives from all the bureaus, from the different forces of the fleets, and, possibly, from the bureau of standards, and probably including a few eminent civilian scientists and engineers,—care being taken not to get a body too large and unwieldy. It would be best to have a small executive council, and allow for calling in of other members when problems, of which they were particularly cognizant, were to be considered.

The close tying together of the different bureaus by their representation on the special board on anti-submarine devices has been of the greatest value to that board in effectively carrying out its mission, and it is believed to have been of considerable value to the bureaus as well, by keeping them closely informed of the work under way and the results being obtained. The close cooperation obtained in England in several organizations combining naval officers, civilian scientists, engineers and manufacturers, was particularly noticed, and it is believed, as a result, that very effective and expeditious work was carried out by this procedure.

Assuming that the departmental part of the research organization can be taken care of, the real difficulty of naval research presents itself. This is the obtaining of the proper grade of research scientists and engineers. The following plan is proposed:

(a) Select a group of naval officers who have shown an inclination toward engineering and scientific research and who are interested in carrying out intensive investigations along their specialties, these officers to be available for this work for a term of years in either administering or actually carrying out research.

(b) Elect each year five or more eminent scientists for a one year appointment as professors of mathematics in the navy (or possibly as lieutenant commanders (technicists) in the reserve force) to serve during a year's leave of absence from their universities or civilian employments.

(c) Designate each year a certain number of Naval Academy graduates to the naval research laboratories for postgraduate work, and provide instructors for them, these officers to specialize in research in the same manner as

officers are now given postgraduate work and specialize in ordnance, electricity, radio, steam engineering, naval construction, etc.

(d) Obtain a sufficient number of young scientific graduates from universities to take up scientific work in the organization, either temporarily or permanently.

(e) Each summer invite at least ten professors or other civilian scientists to carry out investigations at the central laboratory or associated experimental stations.

At the research laboratory ample opportunity should be afforded for research on any problem in physics, with an opportunity for the investigator to publish the results in a journal established at the laboratory, which journal should have a wide circulation throughout the navy, and among civilian scientists and engineers. It is well known that a scientist's chief reward and chief incentive for his work is the acknowledgment of his work, and the credit which is given to him for original investigation or development, by other scientists and the world in general.

It may appear that the navy would not sufficiently profit from its research work unless its results are kept as naval secrets, and it will be seen from the plan here outlined that it is proposed to give publicity to the research work. It is believed that in most matters, if not in all, there is more profit in developing competent men to produce results, than in the results themselves, regarded as naval secrets, for, in the case of national stress, these men can be called upon to use the organization to meet the emergency. It is also felt that many of the applications, arising from the researches undertaken, would be desired for the merchant marine, as well as the navy, and that therefore the navy could not properly restrict them to its own use.

By adopting the scheme for obtaining personnel as suggested above, new blood and new methods of attacking problems would be continuously brought into the organization. Contact would be closely maintained with the civilian scientific developments and researches of the country, without losing touch with the navy's needs and desires. In this scheme there should be no danger of naval research getting into a rut, while at the same time there would be developed, both in the navy and out of it, a trained research personnel capable of understanding and solv-

ing various naval problems as they were presented. The navy would become acquainted with the applications of research to its problems, and the civilian scientists of the country would become acquainted and interested in the navy and its problems.

In the navy we have been inclined to think of a scientist as a long haired crank whose mind is full of complex mathematical formulae and obtuse theories, and that he could be of little or no assistance to us. Many of us, though, who have come in direct contact with real scientists, have found that they take a real interest in our problems, and knowing, as each of them does, some special application of natural laws, they have been able to point out naval problems which we did not realize existed. That is, individual scientists, when acquainted with service conditions, have been able to show that some of their special knowledge of physical laws could be applied so as to simplify our ways of doing some particular thing, and thereby improve the naval service, while we in our ignorance would have been satisfied with things as they were and never realized that better and more efficient ways could be devised.

Let us realize then that the essence of ability is the same in all people, be it naval officer, scientist or business man, and that their minds are really much closer together than we usually grant.

Given, then, a close co-ordination between the proper types of naval officers and scientists, the navy should, in its research organization, become the greatest patron of science in this country, if not in the world, with resultant improvement and progress, not only in the navy, but in the whole country.

Rear Admiral Ralph Earle, U. S. Navy, Chief of Bureau of Ordnance.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

U. S. NAVAL RAILWAY BATTERIES

By Lieut. Commander L. B. Bye, U. S. Navy

When the history of the great war is written, the various activities of the United States Navy in co-operating with the Allies and in contributing in various ways to the offensive measures which finally caused the downfall of the enemy, will be disclosed. The navy's work in transporting troops, the operations of the destroyer flotilla, the convoy system, the activities of the naval bombing squadrons, the success of the North Sea mine barrage, and the many other naval operations conducted at a distance of 3000 miles through Vice Admiral William S. Sims, commander, United States naval forces operating in European waters, will emphasize the fact that the United States Navy was a big factor in overcoming the submarine menace and causing the ignominious surrender of the demoralized German fleet. This article will describe the navy's contribution ashore in the great battles during the closing days of the war with Germany.

The navy actually had engaged on the Western Front from September 6, 1918, until the signing of the armistice, five 14-inch 50-caliber guns on railway mounts which were designed and built under the direction of the Navy Bureau of Ordnance, transported to France, erected and put in operation at a time when the necessity for such long-range weapons was vital. The story of this accomplishment is believed to be of interest to all readers of the Naval Institute Proceedings.

From the beginning of the European War the range of artillery both on land and at sea attracted a great deal of attention. Mounts and guns of increasing range were continually being produced by both the Allies and the Germans. At the time the United States entered the conflict, this competition of long-range guns was at

its greatest height, with the advantage on land decidedly in favor of the Germans.

In the early part of November, 1917, a report was received from Lieut. Commander G. L. Schuyler, U. S. Navy, giving information concerning the maximum range of German guns, mounted near Ostend, which were firing into Dunkirk. These guns were known as the "Leugenboom" guns, and it was ascertained by the British that they were capable of a range of as much as 50,300 yards, or slightly over 28½ statute miles. None of the British guns in this sector could equal this range, and it was evident that the Germans were making great strides in modifying their naval guns so that they could be used on land for long-range bombardments.

In previous wars, the personnel of the navies engaged gave valuable assistance to the armies by landing parties from ships manning naval guns. During the Mexican War, three 64-pdrs. and three long 32-pdrs. were used by General Winfield Scott in his attack on Vera Cruz. During the Boer War one of the British cruisers was practically stripped of her guns, they being taken to Ladysmith, Colenso, and Spion Kop. Naval guns were used during the Boxer Rebellion in China.

The French, English and Germans in this war manned their naval guns on shore with naval personnel. The traditions and calling of the sea naturally led to this practice, as being the most promising one to adopt to attain the most satisfactory results. The guns and their mounts are heavy and differ in many respects from those ordinarily used by armies. Many different difficulties arise which are recognized by seamen as things to be overcome without outside help. Stress of weather and life at sea have imbued the seaman with the idea that on him alone does his own safety and that of his shipmates depend. He must be a doer, and on the moment. The cruel sea waits for no man. This feeling of self-reliance, instilled in the seaman, makes his character peculiarly suitable for such enterprises as operating naval guns on shore. The Bureau of Ordnance was giving particular study to events of the war, and was continuously endeavoring to formulate some plan whereby the ordnance resources of our navy could be brought into active offensive engagements with the enemy. The Navy Department welcomed suggestions from all of its personnel, and

circular letters were sent out to the entire service requesting any person in the service to submit such suggestions as he might have for the improvement of the material of the navy, any ideas for a plan of attack or any scheme for defeating the Germans.

Rear Admiral Ralph Earle, the chief of the Bureau of Ordnance, was so impressed by the progress of the long-range bombardments on the Western Front that, on November 12, 1917, he suggested to the chief of naval operations the possibility of mounting several naval 14-inch guns along the Belgian coast as an answer to the long-range German bombardments of Dunkirk.[1]

The possibilities of this plan appealed to the chief of naval operations, and he requested that the plan be developed in more definite terms as to the number of guns and mounts available, the probable range, the time necessary to prepare for shipment, and the material required to accomplish such an expedition. The United States Naval Gun Factory, the right arm of the Bureau of Ordnance in the many problems connected with the design

[1] November 12, 1917.

From: Chief of Bureau of Ordnance.
To: Chief of Naval Operations.
Subject: Long-range bombardments.

1. From reports of activities, dated September 29, 1917, along the Flemish dunes, the Bureau notes:

"On the Dune Sector, the British naval guns were unfortunately considerably outranged by the German guns. There are no British guns larger than 12-inch mounted on shore here. The big German gun which fires into Dunkirk is generally referred to as a 17-inch. . . . . Its range has been measured as 50,300 yards."

2. The above suggests the possibility of our mounting several naval 14-inch guns along the coast, fitted with high angles of fire, and with specially formed shell, fitted with delayed action fuses, in order to outrange these German guns. Manned by our seamen, a battery of four of these guns might not be a bad answer to the long-range German bombardment of Dunkirk. Of course, in order to develop this range the bureau must have its auxiliary proving ground granted and operating.

3. Even were the guns mounted on vessels off the Belgian coast, and there given a range of over 30,000 yards, considerable damage may be done to German positions. Such a vessel fitted—as it would be—with our new, smoke-producing apparatus, might materially assist Admiral Bacon's monitors in their operations.

(Signed) RALPH EARLE.

and manufacture of naval ordnance, was informed on November 28 of Rear Admiral Earle's ideas, and was requested to make recommendations concerning such an expedition. The calculations of the Bureau of Ordnance indicated that with the standard 14-inch naval shell then available, a range of about 48,000 yards could be obtained with the 14-inch 50-caliber gun. Figures as to what a light 14-inch shell would do were gone into, and it was indicated that a range greater than that obtained by the German "Leugenboom" gun might be expected. The navy's 16-inch gun could easily have outranged those of the Germans, but it was unfortunate that at that time 16-inch guns were not available in sufficient numbers.

Fourteen-inch ammunition in quantity was on hand, and by the entire personnel of the Bureau of Ordnance it was believed entirely feasible to provide all the equipment necessary for the operation of ten 14-inch guns on shore, if such an undertaking should be decided upon. The shipment of 14-inch 50-caliber guns abroad was known to be feasible, for during the summer of 1917 shipments of 14-inch 45-caliber guns had been made without difficulty to the British Admiralty. It appeared from all investigations made in the bureau that if a suitable shore mounting could be developed the navy could have in operation in France a number of 14-inch guns within a period of six months from the time of approval of such a project.

The Bureau of Ordnance considered the subject from all points of view, and discussed the project with many officers. The deeper the matter was gone into the more enthusiastic they became, and the more certain they felt that if these guns could be placed at some point in Flanders and operated by the navy, a useful tactical result was probable of attainment, and valuable assistance would be rendered to the Allied armies.

The drafting-room force at the Naval Gun Factory, under the supervision of Commander Harvey Delano, U. S. Navy, had been over-worked from the beginning of the war, in developing the vast number of new naval ordnance designs which were under way. Nevertheless, they became so interested in developing a suitable device for countering the long-range bombardments of the Germans that they completed their preliminary investigations on

December 10, and submitted to the Bureau of Ordnance an outline descriptive of a shore mounting for the 14-inch 50-caliber gun, Mark IV.[2]

The gun factory's thorough efficiency is demonstrated by its letter, which the bureau forwarded, without change, to the chief of naval operations, urging that an undertaking of this sort be approved.

[2] BUREAU OF ORDNANCE

December 10, 1917.

Subject: Shore mounting for heavy guns.

Inclosure: Description of above mounting for 14-inch 50-caliber gun, Mark IV.

1. There is forwarded herewith a description and accompanying plates of the proposed railroad mounting for the 14-inch 50-caliber gun, also a description of the train carrying the personnel and equipment necessary for the operation of such a gun in the field.

2. It is the intention to use the 14-inch 50-caliber gun, Mark IV, mounted in slide Mark IV. In order to mount this gun and slide on the proposed railroad car, it will be necessary to make a new deck lug and jacking mechanism for raising the gun from the stowed position necessary for transportation to its firing position. A new elevating gear of the arc and pinion type will be required, as the screw type now used will require raising the gun too high from the tracks for stability in transporting.

3. The railroad mounting and equipment for a gun of this size will be of great value in assisting to overcome the fire from large German guns now being used against the lines of the Allies "on the Dune Sector" in Belgium. In addition to this advantage such a railroad mounting would be of considerable value in this country as a mobile battery to act in conjunction with the army in case of invasion.

4. It is estimated that four gun cars and their accompanying trains can be constructed by contract within 90 days after the receipt of drawings, provided the work can be given government priority, both in securing the material and the manufacturing work involved. It is estimated that by giving this work precedence in the drafting room, and with the hearty cooperation of all concerned, the drawings and necessary specifications can be completed by the 1st of February.

5. It is recommended that four gun cars and their trains be manufactured, making four complete batteries of the type described in the accompanying description, and that the six remaining 14-inch 50-caliber guns with the slides be held as spares to replace any of the guns in the battery when worn out or injured.

(Signed) A. L. WILLARD.

The chief of naval operations consulted with the various bureaus concerning their part in the plan in furnishing men and materials other than those which could be furnished by the Bureau of Ordnance. The entire project appeared to be justified in view of the shortage of long-range artillery, as known to exist in the Allied armies, and, on November 26, 1917, the Navy Department approved an organization of five 14-inch railway mounts, with a complete train equipment for each gun, and a sixth train to accommodate the staff for communication between the five batteries when in action at various positions along the lines.

To Lieut. Commander L. B. Bye, U. S. Navy, fell the task of coordinating all efforts to accomplish the manufacture and shipment of guns, mounts, carriages, cars, locomotives, and all other necessary equipment.

The Bureau of Ordnance was instructed to go ahead. Battleship turret-mount designers, together with other men at the Naval Gun Factory, experienced in bridge and locomotive work, were called into action to develop the detailed plans along the lines of their preliminary investigations. Directed by the superintendent, Captain A. L. Willard, and by Commander Harvey Delano, U. S. Navy, the officer in charge of the drafting room, the work moved forward in spite of all discouragements. Holidays and Sundays were sacrificed, and every effort was made successfully to meet on the drawing board all problems connected with this project. Many problems which had not been anticipated were encountered, and it was necessary to refer to all data on French railways and French railway practice that was available in the United States, and also to communicate with the commander of the United States naval forces operating in European waters, for confirmation of data, for it was found that in many cases reports were conflicting.

The excellent work of George A. Chadwick, leading draftsman at the Naval Gun Factory, during these trying days, was very remarkable, for it is due to his excellent judgment and to his confidence and devotion in the solution of the many questionable points connected with the new features in these railway mounts, that they fulfilled their many requirements for service in France.

The Naval Gun Factory is to be congratulated for its remarkable and prompt work in the completion of the excellent designs,

not only of the shore mounts for the heavy guns, but for the equipments and organization of the complete expedition. One hundred thirty-six standard drawings and eleven sketches were ready for submission to the bidders on January 25, 1918.

In order that the immense amount of work in connection with the design and building of the United States naval railway batteries may be understood, it may be generally described as follows:

Each 14-inch naval railway battery was a complete self-sustaining unit, designed to operate individually or in conjunction with the several similar batteries. When two or more batteries were co-operating in the same sector, their activities were directed by a single commanding officer, with headquarters on the naval railway batteries staff train. Fundamentally, each battery consisted of a 14-inch 50-caliber naval rifle carried on a special railway mount, together with ammunition cars and auxiliary cars. The gun, with a muzzle velocity of 2800 foot-seconds, had a maximum range of 42,000 yards. Firing could be effected between angles of zero to 43° elevation. At angles of elevation ranging from zero to 15° the gun could be fired with no support other than the trucks. For firing at any angle within the range of 15° to 43° elevation, it was necessary to place the gun car over a suitable pit foundation to allow clearance for the 44-inch recoil of the gun. When on this foundation the mount was fixed, and its position remained the same for successive shots, while, when firing at the lower angles upon the track, the energy of recoil was absorbed by the car which traveled backward on the rails against the resistance of tightened brakes.

The railway battery was designed to provide utmost freedom from difficulties associated with auxiliary power-driven accessories and from dependence upon a supply base. With exception of a small, combined air-compressor and winch, driven by a single gas engine, the mechanical functions of the battery were performed solely by hand power. Compressed air was used in operating the breech mechanism and in the counter recoil cylinders. Each battery train was provided with ample supplies and spare parts, augmented by stores and equipment carried on the staff train. The cars of the battery train provided facilities for foundation erection, repairs and quarters for the officers and crew. The scope of the

battery is indicated by the following list of cars which made up a single battery train:

1 Locomotive.	1 Battery kitchen car.
1 Gun car.	2 Ammunition cars.
1 Construction car.	3 Berthing cars.
1 Construction car with crane.	1 Battery headquarters car.
1 Sand and log car.	1 Battery headquarters kitchen car.
1 Fuel car.	1 Workshop car.

The locomotives and all the cars were designed to conform to the regulations of the French State Railways. Exclusive of the gun car, the various cars were standard flat cars, gondolas, and box cars similar to those supplied to the American Expeditionary Forces in France, and they could be used in conjunction with the French railway equipment. The fittings of the battery headquarters, berthing and commissary cars, such as bunks, stoves and other appurtenances, were, for the most part, standard naval fittings which could be replenished at any naval base.

While in France the guns were never fired from the rails at low angles of elevation. In all cases the firings were conducted from the pit foundation and at ranges near the maximum. In all cases there was no criticism due to the necessity for installation of the pit foundation. Ample material was provided for the construction of as many as twelve pits, and there was always sufficient time to prepare a firing position in advance of the time set for moving up the gun. In the preparation of a site for firing, the construction cars were brought to the point selected and were used to handle the timbers and steel frame work employed in the foundation. The gun car was pushed over the completed foundation, the truck wheels were locked by brakes, and the weight of the car was transferred to the foundation by means of jacks and lifting screws. In this position a traversing gear provided for 2½° train on either side of the center line of the foundation. During action an ammunition car was brought to the rear of the gun car. Ammunition was conveyed to the breech of the gun by a monorail crane in the ammunition car and a shell tray mounted on a track in the gun car. The personnel of each battery was sufficient to insure satisfactory individual operation. In addition to the officers and crew necessary for the operation of the staff train, its complement included medical and engineer officers and a crew detailed to transportation work among the various batteries as cir-

cumstances required. The staff train was made up of the following cars:

1 Locomotive.	1 Staff construction car.
1 Staff quarters car.	1 Staff workshop car.
1 Staff kitchen and dispensary car.	1 Staff commissary car.
1 Spare parts car.	1 Staff berthing car.

For information concerning the details of the gun car the following brief description is given:

The gun car consists essentially of two longitudinal girders, fabricated of steel plates and structural shapes, and provided with suitable transverse stiffeners. The car is run on two front and two rear six-wheel trucks. A housing in the form of an inverted "U" is provided at each end of the girders for the forward and rear jacking beams used for raising the gun car off from the trucks and placing the car upon the pit foundation. Beneath the jacking beam a center pin casting serves as a socket for the center pin of the car truck. A little forward of the center of the car is a transom casting, against which the transom bed plate bears when the car is jacked up on the pit foundation. Cast integrally with the transom is the pin which engages the transom bed plate of the foundation and the lugs that support the oscillating bearing of the elevating mechanism. The transom is rigidly fixed to the gun girders and is designed to transmit stresses incident to firing to the foundation through the transom bed plate, secured to the inboard side of the girders immediately above the transom by the two deck lugs that support the gun.

Each truck has three axles turning in 9-inch x 12-inch brass journals; the wheels are 36 inches in diameter. The incorporation of the 14-inch gun into the gun car was done in such a way that navy standard fittings could be used as much as possible and the gun, gun slide, breech mechanism and deck lugs were of standard navy design, except that slight modifications were necessary in order to provide for elevations up to 43°. The entire arrangement may be likened to a navy turret installation for a single gun of the *Mississippi* class, mounted on a railway car in such a manner that it may be transported over railways, and when placed on its foundation, fired repeatedly at elevations from 15° to 43° and with a maximum angle of train of 2½° on either side of the center line of the foundation.

The counter recoil mechanism as used in these railway mounts is of interest; for, as originally designed, it was not intended that it would function at angles greater than 30°. In order to provide the increased energy necessary to return the gun to battery at the higher angles of elevation, the counter recoil spring cylinders were modified so that the action of the springs could be augmented by a pneumatic system designed to act with the springs in returning the guns to battery. Air was furnished by the air compressor for this system of counter recoil as well as for the gas ejector system, and it proved highly efficient even during continuous firing when charged to an initial pressure of about 125 pounds.

The gun was laid in elevation, for firing, by means of a gunner's quadrant, and for azimuth by a surveyor's transit mounted on a sight support, which extended out from the trunnion and projected through the side of the car. Except in a very few cases, all firings in France were conducted without observation, and the accuracy with which the guns could be laid in azimuth and in elevation for map firing and indirect firing proved to be as precise as necessary.

The total weight of the gun car complete is in the neighborhood of 535,000 pounds, distributed as follows:

	Pounds
Gun, breech mechanism and yoke	192,500
Slide, complete	50,700
Elevating gear (screw)	650
Elevating gear (nut)	2,930
Elevating gear details	1,860
Deck lugs (2)	10,200
Transom casting	10,000
Cab	12,400
Shell-loading device	1,290
Girders, including the braces (2)	135,830
Trucks (4)	80,000
Truck beams (2)	33,000
Compressor, winch and engine	1,800

The pit excavation and gun-car foundation were designed to meet every contingency that might arise in the field. At the same time it was realized that numerous problems of construction and operation impossible to forecast would have to be solved in practice by the personnel. Approximately 103 cubic yards of earth had to be removed for installing the foundation. The pit

had to be dug, and then by means of a crane car the timber work and structural steel girders were put in place. The transom bedplate casting by which the firing reactions were transmitted to the foundations was required to be approximately level, and the pit had to be installed so that the axis of this casting or the center line of the foundation was in the approximate line of fire.

It was at first thought that the necessity for this pit arrangement might be a severe handicap for the operation of the guns in France, for it was known that considerable time would be necessary for its installation. It proved, however, that this means of taking up the reactions of the gun while firing was decidedly superior to other methods in use, where the gun car recoiled for some distance along the track after each shot. The installation of the pit required from 30 to 36 hours, while the gun could be placed over it in from one hour to one hour and a half. When the gun car was once locked on its foundation, the entire mechanism was stable and properly lined up for continuous and rapid shooting.

The story of the construction of the 14-inch naval railway batteries indicates the nation's patriotic speed in manufacturing, machining and assembling material during the war. The most satisfactory feature of the entire project is the manner in which the entire equipment fulfilled all the hopes of the persons who had to do with its construction. The problems that were solved were numerous and their extent is indicated in the preceding pages. In addition to the actual work of construction, a large amount of entirely new and important data had to be obtained by special experimental work. The problem of securing and training the personnel to operate the batteries when completed, and the task of handling the enormous weights and shipping them abroad for re-erection in France, the actual assembly work at St. Nazaire, and the difficulties connected with their operations on the Western Front were real ones, and the enterprise was successfully accomplished, not on time, but ahead of time. The guns actually rendered excellent service during the closing days of the great war in firing against the enemy at several important strategic points.

The interval from January 25 to February 13 was consumed in making arrangements for the manufacture of the material. The leading men of concerns in the United States for building railway cars, steam locomotives, and constructing bridges were called

together in Washington. The importance of the project was explained to them, to make them realize the necessity for breaking all previous records of war production if they should undertake the work and complete their part in time to enable the guns to participate in the great offensives that were to take place in France during the summer of 1918. To obtain satisfactory bids for this vast amount of work it was necessary, in placing the contracts, to avoid interference with other important war supplies for the U. S. Army, the U. S. Navy and the Allied Governments.

It appeared at first as though the bureau was demanding the fulfillment of impossible conditions. The engineers representing these large manufacturing concerns were thrilled with its extent and appreciated its possibilities; but the task appeared to them impossible, until, during a second conference, Mr. Samuel M. Vauclain, chairman of the Munitions Committee of the War Industries Board, with his customary delight in undertaking problems which to others seem out of the question, assured the Bureau of Ordnance that the Baldwin Locomotive Works would build the gun cars with the assistance of the American Bridge Company in from 100 to 120 days. The president of the Standard Steel Car Company, Mr. J. M. Hansen, was so stirred by Mr. Vauclain's enthusiasm and patriotism that he also came forward and promised to deliver the entire number of auxiliary cars in the same time. The first step in the actual building of the mounts, therefore, was to award to the Baldwin Locomotive Works the building of the six necessary locomotives and the five gun cars, and to the Standard Steel Car Company the construction of the 72 auxiliary cars. The complete equipment as called for in these two contracts was as follows:

6 Consolidation locomotives and tenders (tractive power 35,600 pounds).
10 Ammunition cars.
5 Battery kitchen cars.
5 Battery headquarters cars.
15 Berthing cars.
5 Fuel cars.
5 Workshop cars.
1 Staff quarters car.
1 Staff kitchen and dispensary car.
1 Staff radio and spares car.
1 Commissary car (staff).
6 Construction cars.
5 Construction cars with cranes.
5 Sand and log cars.
1 Executive officer's car.
1 Staff office car.
1 Staff workshop car.
1 Set of equipment for staff workshop car.

Interior of Ammunition Car Lined with Bullet-Proof Steel.

No time was lost in getting started, for the bids were accepted on the day of this second conference, February 13, 1918, and the awards were made by telegraph.

Actual construction of the railway batteries having commenced, the chief of naval operations, on February 19, directed the Bureau of Navigation to provide the personnel for their operation abroad.[3]

Rear Admiral, then Captain, C. P. Plunkett, U. S. Navy, was detailed at his own request as commanding officer of the United States naval railway batteries. It was under his supervision that the personnel was assembled and instructed.

The activities of the fleet during these important days made it impossible to take officers and men from the ships, for they were needed for the duties which they were then performing. In order

[3] February 19, 1918.

From: The Chief of Naval Operations.
To: The Chief of Bureau of Navigation.

Subject: Personnel for Naval Batteries for Operation Abroad.

1. The plans, as approved by the Department, for sending five (5) naval batteries to operate overseas contemplates the following personnel:

1 Commanding officer.
1 Aide (liaison).
1 Medical officer.
1 Supply and pay officer.
1 Clerk.
5 Battery officers.
5 Fire-control officers.
5 Gunners.
5 Machinists.

2. The following enlisted personnel:

5 Chief gunner's mates.
15 Gunner's mates.
5 Machinist's mates, first class.
5 Carpenter's mates, first class.
5 Blacksmiths.
11 Cooks.
16 Assistant cooks and Mess attendants.
12 Radio operators.
1 Hospital steward.
6 Hospital apprentices.
6 Locomotive engineers.
6 Firemen.
6 Trainmen.
60 Fire-control observers.
35 Seamen (gun crew).
115 General ratings, artificer branch (construction crew).

3. Captain Plunkett, U. S. Navy, has been directed to confer with the Bureau of Navigation and Ordnance with regard to the assembling of the personnel and material for purposes of training previous to departure from this country. He will confer with the bureau as to the time and places where this personnel will be needed.

(Signed) W. S. BENSON.

not to interfere with the efficiency of any organization, the personnel was drawn from the naval training stations and rifle ranges, where personnel was being trained preparatory to taking part in the actual operations of the navy. As a result, more than 90 per cent of the complement of the naval railway batteries were men who had no previous experience with naval ordnance material, but they were excellent men who had entered the United States Naval Reserve Force that they might do their part in downing the enemy. They were most attentive in all their instruction, so that with a short course of intensive training, and a little experience on the front, they became imbued with the navy spirit and made good.

The original complement of the batteries called for 449 men and 25 officers. This was later increased to 500 men and 30 officers.

The complement of each of the five batteries was as follows:

Commanding officer.
Construction officer.
Orientation officer.
Medical officer.

ORDNANCE

1 Chief turret captain.
2 Gunner's mates, 1st class.
1 Gunner's mate, 2d class.
2 Machinist's mates, 2d class.
1 Boatswain's mate, 1st class.
2 Coxswains.
1 Electrician, 1st class.
1 Electrician, 2d class.
15 Seamen.

CONSTRUCTION

1 Chief machinist's mate.
8 Ship fitters, 1st class.
8 Ship fitters, 2d class.
8 Carpenter's mates, 1st class.
8 Seamen.

MEDICAL

One hospital apprentice.

COMMISSARY

1 Ship's cook, 1st class.
1 Baker, 1st class.
1 Ship's cook, 2d class.
4 Ship's cooks, 4th class.

The complement of the staff train was:

COMMANDING

Commanding officer.
1 Chief yeoman.

EXECUTIVE

Executive officer.
1 Chief yeoman.

MEDICAL

Senior medical officer	3 Hospital apprentices.
1 Chief pharmacist's mate.	

COMMISSARY

Supply and pay officer.	1 Pay clerk.
2 Assistant paymasters.	1 Baker, 1st class.
1 Chief commissary steward.	3 Ship's cooks, 4th class.
1 Commissary steward.	1 Ship's cook, 1st class.

TRANSPORTATION

Transportation officer.	100 Men of various artificer ratings.

(These men available for general duty among five battery trains.)

To indicate the type of men would require many pages in describing their capabilities; but their character may be understood from a letter by Captain Plunkett.[4]

[4] "Select a detachment consisting of the officers or petty officer (in charge) whose name appears in parenthesis above and 30 other men, for most important duty.

"This detachment should include only excellent men. It should include several men who can do machinist work, electrical work, radio work, concrete work, signalling, locomotive engineers and firemen, trainmen, carpenters, painters, plumbers, blacksmiths, automobile men and an assortment of men of various trades.

"It is not intended that all men should be men of trades; the majority of them should be intelligent and active young men, preferably those with some education. It is not necessary that the men have ratings indicative of their trades. Select excellent all around men without regard to rating. Hold this detachment in readiness for orders.

"Submit to the Director of Gunnery Exercises and Engineering Performances a list of the men showing their rates, branch of service, small arms' qualification, the place from which received, the various duties each has performed at your range and a brief statement of his former occupation, education and things he can do.

"Hold this party as a separate detachment. Have it begin an intensive course of training, covering all the navy small arms' courses, including daily firing for each man. Give plenty of practice with pistols and revolvers, or both, and especially plenty of machine-gun practice, each man with each type of gun. Have plenty of practice at 600 and especially at 1000 yards.

"Every man must have a thorough knowledge of the mechanism of the pistol, rifle, and each type of machine gun. Include no man who is unable

As the secret of an expedition to send 14-inch 50-caliber naval guns to the front gradually spread, oral and written requests for detail to this organization were received from at least 20,000 different officers and men. Any person who had the slightest inkling of the project was most anxious to become associated with this work which was to take him into the most active sectors of the firing line.

For instruction, the men were divided among the Naval Proving Ground, Indian Head, Maryland; the Naval Gun Factory at Washington, D. C., and the Sandy Hook Proving Ground, Sandy Hook, N. J., where they were given intensive training. They were required to put guns in place, load and fire them, disassemble them after proof and become so accustomed to gun-fire that they lost all nervousness. The handling of heavy weights or the firing of big guns became to them only a routine matter. They were required to operate trains; operate locomotives; to build railroad track, and perform any sort of task which was likely to give them experience that would be valuable while operating against the enemy. A number of men were assigned to the Baldwin Locomotive Works and to the shops of the Standard Steel Car Company, to assist in the inspection of the material while building. In this way many men became familiar with the smallest details of each and every part. The expedition demanded experienced men to run the locomotives and operate the trains on the railways of France. About 100 skilled mechanics were furnished from the United States Naval Training Station, Great Lakes, and several engineers, firemen, and others to make up train crews volunteered for enrollment upon being informed of the country's need for them.

Every war seems to possess some creditable record for speed. During the Spanish-American War all records were broken by the *Oregon* in steaming from the Pacific coast to Cuba. In the

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to qualify as sharpshooter or higher. Have daily instruction in signalling, including semaphore, blinker, buzzer and radio, if possible.

"Every night (except Sunday) have instruction. Intensify the work and eliminate all men unable or not disposed to undergo incessant work.

"Make daily report of range practice and of the other instruction to the Director of Gunnery Exercises and Engineering Performances.

"*This is for most important and desirable duty.*"

Boer War the famous gun "Long Cecil" was built at Kimberly in 23 days. In this war the first 14-inch naval railway mount was completed in 72 days from the award of the contract, or 120 days from the commencement of the first preliminary designs.

From the moment that the bids were accepted and contracts awarded the fabrication of the material moved rapidly forward. The construction of the girders by the American Bridge Company progressed so rapidly that they were delivered to the Eddystone shops of the Baldwin Locomotive Works in less time than had been thought possible. When they were delivered, the shop superintendent was fully prepared to assemble. The trucks, air compressors, winches, castings, and other fittings had been obtained in some manner and assembled at Eddystone, so that when the girders came in, no time was lost in attaching the deck lugs, fitting the elevating mechanisms, placing the girder on its trucks, adjusting the gun slide and putting the gun in place. The Naval Gun Factory furnished for each mount all of the strictly ordnance parts; *i. e.*, the gun, slide, deck lugs, elevating gear, breech mechanism, loading device, etc. And in performing this vast amount of work they were always a few days ahead of time. The first mount was scheduled for delivery on May 15, 1918. Mr. S. M. Vauclain, senior vice president of the Baldwin Locomotive Works, made the schedule out himself only to have it broken, for the first mount was completed at the Eddystone plant of the Baldwin Locomotive Works on the morning of April 25, 1918. The last mount was scheduled for June 15, but was completed on May 25.

There were no changes in the design to delay construction. Plates for the girders were rolled at Pittsburgh and rushed in special cars to the American Bridge Company's fabricating plant at Pencoyd, Pa. The material furnished by the Washington Naval Gun Factory was sent to Eddystone by motor trucks, and, in fact, every conceivable method of transportation was used in seeing that the material reached the Baldwin Locomotive Works shops on time. Notwithstanding bad traffic conditions and some of the coldest weather and heaviest snow falls that the Eastern States had experienced in many years, the material reached there, and on time.

While one end of the Baldwin Locomotive Works shop was engaged in erecting the gun cars, the other end was erecting the

locomotives for the expedition. At the plants of the Standard Steel Car Company located in various parts of the country, the building of the auxiliary cars was pushed so that they too were finished in advance of the delivery schedule. In spite of a severe fire and a young cyclone which destroyed a considerable portion of the Hammond, Indiana, shops the auxiliary cars were completed by June 1.

Among the problems encountered in connection with the naval railway batteries was the field available in the United States for proving such a long-range engine of war. The navy had no suitable proving ground, for at Indian Head the range was limited to a maximum of about 15,000 yards. There was only one proving ground in the United States where the firings could be safely conducted. That was at the Army Proving Ground, Sandy Hook, N. J. The only course open, therefore, was to appeal to the army for permission to conduct the proof of the first mount at Sandy Hook.

Permission to test the 14-inch gun and mount at Sandy Hook was granted, and preparations were made to carry out the work.

The men who were on the station for instruction built a special siding and installed the first pit foundation upon which to test the gun. These men at Sandy Hook had become almost expert in laying new track and making track repairs, for it happened that about two weeks before the first gun was expected to be ready for test, a severe storm raged for several days which caused such a violent sea to beat in on the sandy beach that the government track connecting the proving ground with the Central Railroad of New Jersey at Highlands was badly washed out in many places, and, in one place, was entirely destroyed for a distance of about 1000 yards. Sandy Hook, instead of being on a peninsula, for a short time was on an island. The blue-jackets on the station assisted the army materially in making repairs to this government line. They realized that the track had to be renewed in as short a time as possible if the railway mount was not to be delayed in arriving at Sandy Hook.

Arrangements were made with the Philadelphia and Reading Railroad and the Central Railroad of New Jersey to move the mount from Eddystone to Sandy Hook by a special train. Up to

this point everything in connection with the project of sending long-range guns abroad had been kept confidential, but on this trip, where it was necessary to pass through Philadelphia and other cities, the nature of the undertaking began to become public. It was impossible to transport such a huge device over the railways without attracting attention. The gun and its mount were covered over as well as possible, and camouflaged in such a manner that at least the details could not be discerned by observers who might be along the tracks while the train was under way.

The movement of this first gun from Eddystone and its test at Sandy Hook were among the most important events in the life of the naval railway batteries, for the entire enterprise depended upon satisfactory results, both in transportation and in firing.

The officials of the Reading Railroad were most courteous in cooperating with the navy in this shipment by special train. They selected one of their most able train crews for the journey. Coaches and a special car were attached to the train, in order that meals could be served and every one made comfortable during the trip.

Rear Admiral Plunkett, Captain T. A. Kearney, assistant chief of the Bureau of Ordnance, most of the officers who were to go abroad with the batteries, and several others from the Bureau of Ordnance accompanied the train to observe its performance in transit. Undoubtedly, in handling the movement of this gun car the Reading and Jersey Central Railroads successfully handled over their lines the heaviest piece of rolling stock ever transported over the railways in the United States, and for that matter over any railway in the world. The mount as it stood when it made this trip weighed over 250 tons; the load between the rails and wheels of each axle on the rear truck being 39,630 pounds, while on the front truck the reaction on each axle was 50,330 pounds.

There had been considerable anxiety concerning these axle loads, for they were criticised by officials at home, and the French authorities were doubtful if it were safe to transport such a concentrated weight over the French railways. The navy's engineers were confident that the axle loads would not prove excessive, but, in view of the many criticisms, there was the possibility of being mistaken, until the actual tests had shown everything to be satisfactory.

During the construction period of all this equipment the contractors and all persons having to do with its building were spurred in their efforts by the repeated accounts of the German long-range guns firing into Paris, and the reports of the telling effect of the German long-range guns all along the front. The "German Berthas" were doing considerable damage to material and were having a serious influence on the morale of the French people. The navy's foresight in preparing the expedition for foreign service was appreciated during May, for it was at this time that the Germans were making rapid advances, and the channel ports were threatened. Through the office of Naval Intelligence information was received that 380-millimeter guns originally intended for the *Hindenburg* had been mounted by the Germans, one near Lille, to fire upon Dunkirk; one at St. Hilaire-le-Grand, to fire upon Chalons-sur-Marne; the third near Pont-à-Mousson, to fire on Nancy, and four more had been mounted two months before in a wood four kilometers above Crepy, Laon. It was definitely established that 16 heavy naval guns had left Kiel towards the end of May for Belgium. They were believed to be 305-millimeter guns, manned by naval personnel, and were probably attached to the Marine-Sonder-Kommando.

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large gun mounts will be finished complete in every respect ready for shipment Saturday, May 18, or about two (2) weeks ahead of time originally contemplated.

Our people at the works are most enthusiastic over the standard of workmanship on the parts furnished by the Washington navy yard to go on these mounts. The last piece arrived at 6.40 Saturday evening last.

This has been a most delightful task. The designs were thoroughly worked out before hand. Your Department knew exactly what it wanted. The parts furnished by the navy yard came through on time and in the best possible shape. Not a single difficulty was experienced and I trust that the service rendered by the Baldwin Locomotive Works may prove satisfactory.

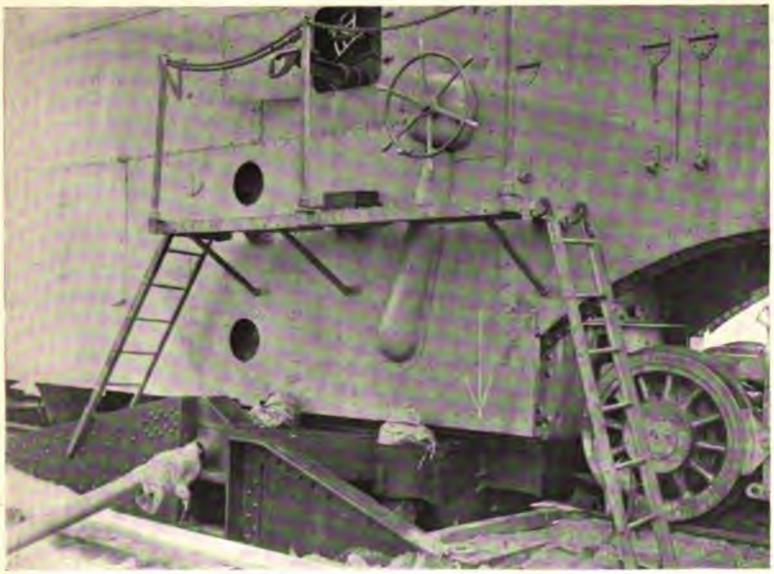
Work has been begun on the three (3) additional mounts and a schedule of delivery will be sent you at an early date.

Very truly yours,

S. M. VAUCLAIN,

Senior Vice President,

Baldwin Locomotive Works.



THE GUN CAR RESTING ON PIT FOUNDATION.

FLAT CAR THROWN ON TOP OF AN ADJACENT CAR BY ONE SHOT FROM No. 1 GUN OF THE U. S. NAVAL RAILWAY BATTERIES FIRING AT LAON, FRANCE.

The High Commission of the French Republic in the United States appealed to our War Department for assistance in early deliveries of long-range artillery.[7]

The Navy Bureau of Ordnance had, early in the war, furnished to the Ordnance Department of the army a considerable number of naval guns varying in caliber from 3-inch to 12-inch, and, by special arrangements, a number of 14-inch 50-caliber guns subsequently were released by the navy for their use during the summer of 1918. While effort was made by the army to place these guns in operation in France, so far as is reported, only a few of the minor calibers were ever shipped abroad, and no successful mounts were fabricated for the larger guns in time to permit them actually to take part in the war. After the Sandy Hook firing of the naval mount, the Ordnance Department of the United States Army requested the Navy Bureau of Ordnance to build three similar mounts for them. These three were completed the latter part of August, and, the rapidity of their construction being satisfactory to the army officials, they duplicated their order for an additional three which were finished by October 1.

As mentioned in the beginning of this article, the original tactical use that led to the building of these mounts was to answer the long-range German bombardments of Dunkirk. By May 15, with the completion of the entire project actually in sight, and at most one or two weeks' distance, conditions in France had changed entirely. The threatening of the channel ports made it impossible to risk shipment to the British transportation centers. It was decided to communicate with General Pershing to determine if the guns could be of use to the American Army. On May 23 General Pershing showed his appreciation of what the navy had accomplished by requesting shipment of the guns, railway mounts, and

[7] Extract from the letter of the High Commissioner of the French Republic in the United States, dated May 30, 1918:

"On account of the present circumstances which render more and more urgent the necessity of a long-range artillery, able to reciprocate the firing of similar guns to those which fire actually on Paris, the organization on 340-millimeter carriages of 14-inch guns already existing, or the manufacture of which is under consideration, as expressed in my letter of the 14th instant, takes every day an increased importance."

(Signed) High Commissioner of
the French Republic.

rolling stock to France immediately. St. Nazaire was assigned as the port of debarkation, and the one requirement made by the army was that the transfer to France should be accomplished without demand on army tonnage.

Pershing's word filled the personnel of the naval railway batteries with enthusiasm. Arrangements were immediately made with the Bureau of Supplies and Accounts for the necessary shipping.[a]

The detail of men at the Naval Gun Factory, the Naval Proving Ground, Indian Head, Md., and the various inspection districts were ordered, by telegraph, to assemble in the navy yard, Philadelphia, preparatory to proceeding overseas.

The first draft of 250 men and eight officers, Commander Garret L. Schuyler, U. S. Navy, in charge, sailed for Brest on May 26, 1918, arriving at St. Nazaire on June 10. The second draft of 207 men and six officers, with Lieut. Commander J. W. Bunkley,

[a] To: The Bureau of Ordnance.

1. In accordance with cablegram, War Department, copy of which has been handed Lieut. Commander Bye this date, instructions have been issued by the navy to ship material for the 14-inch new railway battery by the first available naval transport.

2. It is expected that part of this material will be loaded on the U. S. S. *Bath*, sailing for St. Nazaire direct; also other shipments on the U. S. S. *Newport News*, and on the U. S. S. *Texel*, sailing direct.

3. It is requested that the bureau issue any instructions which they may consider necessary to safeguard the handling and shipment of this material to the Bureau of Supplies and Accounts, with a request that they immediately inform their representatives at Philadelphia to exercise proper precautions in the loading of these vessels.

4. It is also requested that the allowance of ammunition be divided among the above-named vessels and shipped at the same time as the material.

5. A large part of the personnel will precede the material with instructions to make all necessary arrangements for the proper reception and erection of the bureau's material on the other side and for such temporary or permanent storage of the ammunition allowance and reserve as may be determined from time to time.

6. Any suggestions which the bureau may have to make in regard to the handling of this whole situation are earnestly requested, in order that no stone may be left unturned to insure the safety of this material from the time of departure until active operations begin, and as far as possible, thereafter.

(Signed) C. P. PLUNKETT.

U. S. Navy, in charge, sailed on June 15, arriving at St. Nazaire on the 29th. Commander Schuyler commanded the naval detachment in France until the arrival of Captain C. P. Plunkett on July 16.

Besides the usual difficulties connected with the shipment of such heavy material, the journey to France at this particular time was extremely dangerous. It was during this same interval that German seagoing submarines were operating off our coast, laying mines and sinking numerous vessels by gun fire. Every one will recall how persistent these pirates of the sea were in their activities. How they appeared one morning so close in shore off Cape Cod, that, while sinking a number of innocent barges by gun fire, the shells actually fell on the beach. The *San Diego* was sunk by a torpedo from one of these submarines or by one of the mines laid by them, and even the U. S. S. *Texel,* which had been designated to carry a cargo of material for the naval railway batteries, was sunk on June 2 while nearing port, so that another vessel had to be substituted. The first shipment from Philadelphia was actually made on the U. S. S. *Newport News* on June 20, and shipments followed on July 4 by two steamers, the *Bath* and *Pensacola.* The *Newport News* arrived safely at St. Nazaire on July 8, while the two latter ships required until July 21 and July 27, respectively. Other shipments followed on the *Malang* and *Rappahannock,* which arrived at St. Nazaire on August 11 and 15.

During the entire construction period of the material for the railway batteries the work was supervised by Lieut. Commander D. C. Buell, U. S. N. R. F. It happened that Mr. Buell was visiting in Washington at the time the contracts were being awarded to the Baldwin Locomotive Works and the Standard Steel Car Company. He appeared in the Bureau of Ordnance one morning and expressed a desire to assist in war work. Mr. Buell was known to be an excellent railroad man, so he was immediately enrolled as a lieutenant and assigned as a special inspector to handle all the material for the expedition. He performed this work most ably, and upon its completion he was sent to St. Nazaire to assist with the work of erection in France, where he remained until the assembly was completed.

Lieut. Commander George T. Ladd, U. S. N. R. F., from Pittsburgh, Pa., gave up his own business and volunteered to take up

the inspection work while Mr. Buell was abroad. Lieut. Commander Ladd was familiar with the entire project, for he had assisted Mr. Buell for several weeks during the busiest days as a sub-inspector of ordnance. He was a very competent officer, for under his supervision six railway mounts similar to those with the United States naval railway batteries were built for the Ordnance Department of the army, and besides, he handled the inspection of a large contract for 7-inch tractor mounts that were building for the United States Marine Corps. Many men of the type of Ladd and Buell volunteered their services to the government during the war, and it is hoped that *their* assistance was appreciated by others as much as the navy appreciated the services of these two men.

Lieut. Commander Buell arrived in St. Nazaire on June 20. At this time a majority of the preliminary arrangements for the expedition in France had been completed by Commander Schuyler. A site for barracks had been obtained and the construction of the barracks was well under way. Arrangements had been made for mounting the guns in a French shop that was in use by the 19th Engineers, U. S. A.* Arrangements had been made with the 19th Engineers for the use of space in their railroad yards for storage and construction purposes. Permission had been granted by them for the use of as much scrap lumber, from locomotive packing cases, as was necessary to complete the barracks. Conferences had been held regarding the movement of the guns over various railroad lines. Many other details were being worked out concerning the general conduct of the expedition after the assembly had been completed.

The 19th Engineers, all railroad shop men in civil life, were very friendly and willing to co-operate in every manner. Commander F. P. Baldwin, U. S. N., naval port officer at St. Nazaire, took keen interest in the work and assisted in every possible manner.

Conditions at the port were not entirely satisfactory. There was shortage of labor and congestion in the yards, due to the vast amount of material arriving from the States.

The first shipment of the navy material was not expected to arrive for at least two weeks, so it was decided to distribute as many navy men as possible about the port at places where they would be learning the yards, the shops and, at the same time, ren-

dering service to the army. With this in view, an experienced round-house foreman and 15 mechanics were detailed to the 67th Engineers; 50 skilled mechanics to the 19th Engineers, and three switching crews, four engineers and firemen were detailed to work with the army in the yard. All of these men were very badly needed, were eagerly accepted and they made good in every particular. Rear Admiral Plunkett was especially anxious to assist the French and the Americans in every way possible, for he appreciated that by so doing they would reciprocate in granting many favors to the navy while their material was being assembled. As opportunity offered, several trips were made by automobile to points on the railroads out of St. Nazaire to inspect the road bed and bridges, with reference to their capacity for carrying the naval mount safely. These inspections convinced the officers that the road bed was perfectly safe for the guns, and that all the main line bridges were safe for moving at slow speed and, in most cases, were safe for moving at any reasonable speed.

Captain Debonett, a French artillery constructor, who, in civil life, was a bridge engineer, visited St. Nazaire and went into detail in regard to the bridges, axle loads, etc., with the result that he was absolutely convinced of the safe carrying capacity of the French bridges for the naval expedition; but he was somewhat doubtful as to the track holding up under the weight of the gun. So with absolute confidence, on the part of the naval officers, that the French track was entirely adequate, and with full confidence in the bridges, on the part of Captain Debonett, it was decided that there would be no difficulty in moving the guns almost anywhere in France.

When the *Newport News* arrived, the naval battery was ready and waiting to proceed with the assembly work. The army's experience had demonstrated that in all cases it was advisable not to start actual erection until all material necessary for a complete unit was actually on hand and in the yard. This proved to be the best practice with the navy material as well, for in making hasty shipments from the United States it was impossible to separate the enormous number of parts into those pertaining to individual trains; and, consequently, at St. Nazaire, when the first ship arrived, it was found that necessary component parts were missing and nothing was to be gained by commencing the erection of material before all had reached port and been unloaded.

The locomotive and car erection began on July 20. The assembly of the first gun was begun on July 26, and the first train was completed and ready to leave St. Nazaire on August 11.

In all the assembly work the men were seriously handicapped for, in some unexplainable manner, all blueprints were missing. The resourcefulness of the American blue-jacket was here again made evident, for those who had been detailed to assist in the inspection work at the Baldwin Locomotive Works and the Standard Steel Car Company had kept individual notebooks. They had taken them to France, and with the sketches that these notebooks contained many an unknown step in the putting together of the gun cars and the various other parts was accomplished.

It is needless to state that the work at St. Nazaire was done under high pressure. Admiral Plunkett was continually receiving urgent requests to expedite the work and get his guns to the front.

Orderly procedure in the work of erection as intended in the beginning was considerably interrupted, in order to comply with these urgent demands. The original schedule was rearranged and special effort was made on the first two trains which made them available for leaving St. Nazaire on August 18 and 19, each with 100 rounds of ammunition per gun.

The manner in which Rear Admiral Plunkett and his men overcame all the difficulties of the complex assembly work did credit to the best navy traditions. Seamen all, they worked till they dropped exhausted, and their night and long day hours of labor were continuous until the guns left for the front.[9]

[9] Extract from Lieut. Commander Buell's letter to Captain Kearney, dated 8/28/18:

"We have had no construction difficulties of any kind, other than lack of material when we needed it. The ships were all loaded upside down, and we were not able to get started on the construction job until the last of the stuff on the second ship was unloaded and on the ground in the yard. From that time on we have made good speed. . . . .

"On the selection of men I was very fortunate. There has been only one thing in the whole project that we were not able to find a competent man to handle, and that was the job of putting the lagging on locomotive boilers. We borrowed a man from the army and made out all right. I thought I was out of luck for a man to do lettering and stenciling of cars, but on combing the outfit I found three experienced lettering and sign painting men and had no further trouble on that score."

The urgent need for the first two guns at the front was in order that they might perform a special mission of firing upon the German long-range gun which, at that time, was bombarding Paris. Admiral Plunkett devoted special attention to the assembly of these two mounts and took personal charge when they moved from St. Nazaire.[10]

The first train, after being inspected on August 17, 1918, by the Assistant Secretary of the Navy, Franklin D. Roosevelt, left St. Nazaire on August 18, 1918, followed by the second train on Monday morning, August 19. The schedule called for the train to pass over the Orleans, État and the Nord systems. The total distance was more than 350 miles, and the destination Helles-Mouchy. A speed of six miles per hour was set, for it was considered that, as the material was all new and there was some question about the weights involved and the strength of the bridges, a speed greater than this in the beginning might have involved some questions which it was desired to avoid until it was proven that the French road beds and the naval railway rolling stock were both capable of successfully meeting all situations.[11]

[10] Extract from Naval Railway Battery Report on Material for week ending August 17, 1918:

"I will proceed with the first train to the front to-morrow morning, establishing a "garage" on the railroad near Creil. The French naval batteries were already there when I visited them this week. It is about 45 minutes automobile run from La Morlaye, a French General Reserve Headquarters. The gun positions were determined during my recent visit there, but a new position, I understand, has been selected and I will inspect them on arrival of the first train.

"In connection with the anxiety of the axle loads involved in our gun mount, it may be of interest for you to know that we have tried all the tracks in St. Nazaire, culminating in a passage over a temporary crib work which rather shocked the railroad people, but demonstrated that this mount of ours negotiates things that were never contemplated in its original design.

"(Signed) C. P. PLUNKETT."

[11] Extract from Admiral Plunkett's letter to Commander U. S. Naval Forces Operating in European waters, dated August 27, 1918:

"Both guns arrived at Helles-Mouchy ready for action, but upon arrival a change in the original plan for the guns was made by the chief of French reserve artillery and I was requested to take one of the guns to Haussimont, the A. E. F. reserve artillery base (and the base to which the remaining guns will be sent in accordance with request from commanding general,

This first trip in France was a memorable occasion, for many French cities, including Paris, were passed through and the French people on seeing that large American engines of war were actually in France, were happy and encouraged. When passing many troop trains loaded with American soldiers cheer after cheer was given. On all occasions as soon as the gun was seen crowds gathered and went wild with excitement. Word of its coming was flashed ahead of the train so that at many stations people had gathered in curiosity and many had come with flowers and wreaths to decorate the big weapon. Many were surprised and agreeably startled when they found that the wreaths were too small for this gun and would not pass over the muzzle. Information concerning

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A. E. F.). The situation, then, is that we have one gun at Helles-Mouchy which can be used for operation in the original sector as contemplated by the French and the other gun at Haussimont, which will conduct some trial firing at Mailly and then be available for service as may be requested by reserve artillery command. I shall proceed to St. Nazaire at the end of the week ending August 31, for the purpose of conducting the movement of the remaining guns, together with the supplies and material, to Haussimont.

"It has been a matter of great satisfaction that we have fully demonstrated to the French authorities that these guns and mounts can be moved over the standard railway tracks and bridges at speeds which are safe, and without damage to the right of way. I was always of the opinion that would be the case, but in some unaccountable manner, before my arrival in France, this question of the safe transportation of the guns, as mounted, over the French railroads had become a matter of official correspondence between our army and the French military and railway authorities. As soon as I could locate all the threads of the matter I personally took the matter up with the French authorities, and, as a result, have succeeded in carrying out movement of two guns to a designated position 350 miles from St. Nazaire, and have further transported one gun immediately from behind the Allied line from Creil to Chateau-Thierry and along the Marne to Epernay and thence to reserve artillery base, A. E. F., Haussimont. It has been a most valuable experience for our personnel, and has given us an opportunity to breathe the atmosphere surrounding that part of the front where our own naval forces made their famous stand, and also to move over lines which were once destroyed and since rebuilt. In fact, as I write this report the movement of the train is held up, pending the ceasing of enemy operations, either by gun fire or bombing, in the immediate vicinity of the train. All of this is of the greatest value in preparing young material for active work, and I shall endeavor to take the remaining guns over the same route as the first gun, in order to give them the same opportunity of observation and experience."

the guns spread over France, and undoubtedly reached the Germans, for when Battery No. 1 arrived at Helles-Mouchy at 8.30 p. m., August 23, and Battery No. 2 on August 24, the German long-range gun had been withdrawn. "The bird had flown." The bombardments of Paris had ceased before the naval guns had taken position to fire a single shot against them.

The cessation of bombardments of Paris gave the naval railway batteries a few days in which there was no immediate mission for the guns. It was decided to fire a few rounds to demonstrate to the foreign officials what sort of duty these guns were capable of performing, and to test out the assembly work that had been done at St. Nazaire. Battery No. 1 was chosen for the test firing and left Helles-Mouchy at 6 a. m., August 27, from where it proceeded to the French proving ground at Nuisemont on August 28. Battery No. 2 in the meantime proceeded to Rethondes in the forest of Compiègne to fire upon an ammunition dump at Tergnier.

The proving ground test of Battery No. 1 at Nuisemont was most encouraging. The pit was installed in time so that on September 2 four rounds at reduced velocity and four rounds with full charges were fired. The territory available was not sufficient to allow firing the naval guns at their maximum elevation. The gun was laid for a range of 29,000 yards. The shots actually fell at 29,000, 29,300, 29,000 and 28,900, respectively. It is needless to say that the French were very much pleased with this firing, for the low dispersion was declared by them to be most remarkable, and they refused to allow further expenditure of ammunition for demonstration purposes. They concluded that the guns were perfect in all respects, and that the proper place to conduct future firings for demonstration or other purposes was at the Front, smashing German positions.

Meanwhile Battery No. 2 had laid track and prepared the firing position at Rethondes under direction of the 10th French Army. On September 6, 1918, after firing only one shot, orders were received to cease firing for the Allies had captured the village of Tergnier.[12] By a peculiar coincidence it happened that Bat-

[12] Extract from Schuyler's letter of Sept. 24/18:

"Finally we were all ready to fire at Tergnier, and the spotting plane was up, but could not observe and failed to give us one signal, and then ran out of gasoline, and anyhow the French troops at the time were capturing

tery No. 2, when firing this first shot from the naval railway battery in France against the Germans, occupied the same position as occupied by the train carrying General Foch and his staff at the time the armistice was signed later on November 11, 1918.

There was continuous demand for the American naval guns; so, as soon as they had concluded their firing at one point they received orders to proceed to another. Battery No. 1 went from

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the town. As the gun was loaded, however, they let us fire it. The sand packing behind the back timbers had not been very well done in this pit, so it came back one-half inch. This would not have been serious, but we profited by it in subsequent installations. We never learned where the shot fell, but I think it went its 41,000 yards all right, and that it was the longest-range shot that had so far been fired at the Germans.

"Then they moved us up the track at night to a place called Fontenoy. They have lots of air raids and bomb the tracks, so that at least every 100 yards has at some time been hit and repaired. There was an air raid just before we started which cut all the telephone lines, and we had to crawl along slowly to see whether the track had been cut, and to get permission from each station to proceed to the next. Fontenoy was in the hands of the Germans during the last push. Our target there was an ammunition dump at about 38,600 yards. The first time we fired we got off two rounds, but the plane could not see them. There were woods near the target, so we changed the range of the second 1000 yards to get it out in the open. Still the aviator could not see it and he ran out of gasoline. We had to wait for another occasion because of bad weather, but then got hurry-up orders to fire 10 rounds without observation. We do not know how we came out on this, but they could hear us all over the front. Four of the observation balloons in front of us were burned down in two days. They could not have seen our shots anyway, however.

"The next day we tried an observation shot again and could pick up nothing for the first two rounds. The aviator spotted from a height of 6000 meters and had a gale of about 90 kilometers an hour, blowing him towards the German line. He got his hand and his face frozen. On the third round, he saw our burst about 1000 yards to the left. I had jacked over about 600 yards when we got the signal to fire again, so let it go at that, and was given OK in direction, but 1300 yards over. We were firing purposely 1000 yards beyond to register in a clear spot, if possible. On the next round, I brought it down 1300 yards and left the direction unchanged. He reported that he could not see the bursts well at all from this height, but is sure that we hit some ammunition on the third round. We were told to finish out our 10 rounds, so we shot the last seven rapidly. We knew we were on in direction and were 1300 yards over while intending to be 1000 over, so we felt quite pleased with the probable accuracy of the estimated range of the remainder. The last seven shots (six intervals) we got off in 25 minutes."

the French proving ground to Soissons, where, on September 11, position was taken near St. Christophe Cemetery while Battery No. 2 proceeded to Fontenoy-Ambleny.

While these first two batteries were actually operating, work was continuing at St. Nazaire on the remaining three. Train No. 4 left St. Nazaire for Haussimont (Marne) on September 15, 1918, and was followed by Trains No. 3 and No. 5 on September 16 and 17. They arrived at the railroad artillery reserve base, Haussimont, on September 23, 24 and 26, respectively.

Some delay in the firings of Batteries Nos. 1 and 2 occurred, owing to weather conditions preventing observation by aeroplane or by observation balloon. It was decided to proceed without observation, so on September 14, Battery No. 2 fired 10 rounds at an ammunition dump in Besny-Loisy, which is just west of Laon. Battery No. 1 on September 28 fired its first shots into the German lines by putting 47 rounds over between the hours of 1 and 5.30 p. m., at a range of 34,320 yards. The target was the railroad yard. The retreat of the German forces from Laon began on September 28 while the U. S. Navy long-range bombardments were in progress. Battery No. 1 continued firing until dark, when it was necessary to cease on account of the flashes of the gun being easily seen by the enemy. Enemy bombing operations in the vicinity of Batteries Nos. 1 and 2 were of frequent occurrence. They were successful as far as French material was concerned, but no damage was done to the United States guns.

Battery No. 2 again fired 12 rounds into Besny-Loisy on September 15, making a total of 22 rounds after which the gun was withdrawn and taken on October 6 to Flavy-le-Martel, where they arrived on October 8. Battery No. 1 remained at Soissons until October 24, firing in all a total of 199 rounds from the same pit foundation. One hundred and twelve rounds were fired at the railroad yards to the northwest of Laon on September 28, 30, and October 2. On October 2 the target was shifted to a point northeast of Laon, where the remaining 87 rounds were fired at ranges varying from 38,000 to 36,660 yards. In all these firings from Battery No. 1, observation of the fall of only 23 shots was possible.

Battery No. 1 had innumerable interesting experiences and narrow escapes while in action at this point. Every one in the vicinity was most anxious to visit the gun, and they gasped in

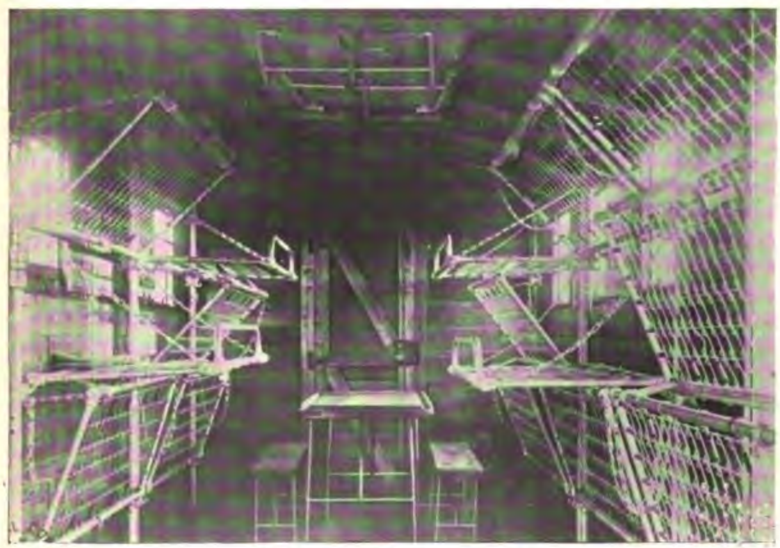
wonder as the weapon hurled the enormous projectiles from its muzzle toward the retreating Germans. French and American nurses from a hospital at Villa-Cotterets took particular delight in going to the front to witness the action of the gun, because the Germans were hurling bombs upon their hospital every night, and it must have been very gratifying to them to witness the retaliation that was being administered by the American blue-jackets. Officers from the Allied armies repeatedly inspected the mount and observed its action. Military visitors were so numerous that the gun's crew was frequently interfered with, and it was necessary to hold back the more curious by putting up a rope fence. Congressmen who were in France to observe the operations of the American Army also took the opportunity to visit Battery No. 1, and in one instance one of these gentlemen wrote his name upon the projectile before it was hurled against the Germans.

Shells from the enemy were continually passing over head, and frequently falling in the vicinity of the battery. On October 5, at about 4.30 p. m., an enemy shell burst directly overhead followed by three other high bursts. Then regular fire began, shells over the train, to the left and in the road. One shell struck 16 feet from the gun. Fragments hit the side plates on the left side, cutting the train air line, piercing the plate close to the left elevating wheel and striking the support to the gas engine, breaking one piece of the casting but doing no injury to the engine. This shell interrupted two men in their daily sanitary operation of scrubbing clothes. These two men had been ordered away from the gun when the commanding officer noted the first high burst. They abandoned their clothes bucket only to have the German shell strike it and the fragments flew in all directions, causing minor injury to the gun mount.

The German retreat from Laon left the former targets of the naval railway batteries in the hands of the Allies. Rear Admiral Plunkett on October 14 visited this sector, going over the ground carefully. It was not difficult to recognize the shell craters formed by the explosion of the 14-inch naval projectiles. They were easily identified by their uniform size and great extent, and, some contained a few fragments of the shells themselves from which identification was made positive. The fragmentation of the shells was most excellent. No "duds" were found. All

Ammunition Car.

Placing Screen Over Gun-Car "Camouflage."



Interior of Berthing Car.

During the construction period of all this equipment the contractors and all persons having to do with its building were spurred in their efforts by the repeated accounts of the German long-range guns firing into Paris, and the reports of the telling effect of the German long-range guns all along the front. The "German Berthas" were doing considerable damage to material and were having a serious influence on the morale of the French people. The navy's foresight in preparing the expedition for foreign service was appreciated during May, for it was at this time that the Germans were making rapid advances, and the channel ports were threatened. Through the office of Naval Intelligence information was received that 380-millimeter guns originally intended for the *Hindenburg* had been mounted by the Germans, one near Lille, to fire upon Dunkirk; one at St. Hilaire-le-Grand, to fire upon Chalons-sur-Marne; the third near Pont-à-Mousson, to fire on Nancy, and four more had been mounted two months before in a wood four kilometers above Crepy, Laon. It was definitely established that 16 heavy naval guns had left Kiel towards the end of May for Belgium. They were believed to be 305-millimeter guns, manned by naval personnel, and were probably attached to the Marine-Sonder-Kommando.

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large gun mounts will be finished complete in every respect ready for shipment Saturday, May 18, or about two (2) weeks ahead of time originally contemplated.

Our people at the works are most enthusiastic over the standard of workmanship on the parts furnished by the Washington navy yard to go on these mounts. The last piece arrived at 6.40 Saturday evening last.

This has been a most delightful task. The designs were thoroughly worked out before hand. Your Department knew exactly what it wanted. The parts furnished by the navy yard came through on time and in the best possible shape. Not a single difficulty was experienced and I trust that the service rendered by the Baldwin Locomotive Works may prove satisfactory.

Work has been begun on the three (3) additional mounts and a schedule of delivery will be sent you at an early date.

Very truly yours,

S. M. VAUCLAIN,

Senior Vice President,

Baldwin Locomotive Works.

fuses functioned and the nose of one shell was found five kilometers from the target. General Mangin and the French artillery command were delighted with the work of the guns, for when working with the map only and without aeroplane observation, the shots in nearly all cases were effective hits, and where aeroplane spotting had been possible and the corrections applied on subsequent shots, they had been perfectly placed.

The effect on the railroads leading out of Laon was all that could be desired. One hit from the 14-inch naval guns was sufficient to wreck a railroad line of three tracks for a distance of at least 100 feet, tearing the rails up, shattering the ties and blowing an enormous crater in the road bed. Although the Germans would repair at night the damage done by the guns, and thus maintain some communication, the interruption must have caused them serious concern, both when holding their ground before Laon and also during their retreat.

In the way of concrete evidence regarding the punishment inflicted upon the Germans, Admiral Plunkett learned that one projectile had struck a German moving picture theater during a performance, killing 40 outright and severely mangling at least 60 others. Two other shells struck this same moving picture theater, and it was completely demolished, together with several surrounding buildings. One freight train on a siding had been struck and one car was completely lifted from the track and thrown a distance of about 30 feet.

On October 11, 12 and 13 Battery No. 2, which had taken position at Flavy-le-Martel, southeast of St. Quentin, fired 35 rounds without observation against Mortiers, an important railroad center north of Laon. Nos. 3, 4 and 5 remained at the reserve artillery base of the American Expeditionary Forces at Haussimont until October 12, when they were ordered to take a position at Thierville on the outskirts of Verdun. Three gun pits were put in at this position and two pits put in at Charny, about three miles further north. Attempts were made on several days to get observation, but without success. On October 23 one round was fired from each battery at the railroads passing through Longuyon, 38,580 yards map range. But due to heavy mists the aviator was unable to observe. On October 29, due to the activity of the enemy's forces coming into Mangiennes (a concentration

of troops at this point) Batteries Nos. 3, 4 and 5 kept up an intermittent bombardment of the roads leading into this town. Ten rounds were fired from each gun at a range of 26,000 yards.

Batteries Nos. 1 and 2 after having performed so satisfactorily in the vicinity of Soissons with the French 10th Army, were ordered to join the 1st American Army of the A. E. F. The two guns arrived at Nixeville, just south of Verdun on October 28. Battery No. 2 immediately occupied one of the gun positions prepared at Charny, and Battery No. 4 was moved from Thierville to the other position there.

It was absolutely impossible to get satisfactory aeroplane observation. Six rounds from Batteries Nos. 3 and 4 were fired at open fields near the targets, in order that aeroplane photographs could be obtained and the range corrected accordingly. On the 30th and 31st six rounds per gun were fired on each day. The two guns at Thierville firing at an aviation field south of Longuyon, and the two guns at Charny at points near Montmedy. Aviators flew over the targets shortly afterward, but due to their height, 5200 meters, satisfactory photographs were not obtained.

Battery No. 2 bombarded the railroad yards of Montmedy with 43 rounds on November 1 and 2. At this time General Foch was preparing for an enormous offensive east of Metz, and the French requested that two of the naval railway battery mounts be assigned to take part in this important operation.

It was decided that Batteries Nos. 1 and 2 should be assigned to comply with this request of General Foch, while the remaining batteries would remain at Thierville and Charny to keep up the bombardment of Montmedy and Longuyon. Battery No. 2 left Charny on November 3 and arrived at its firing position at Moncelle-Luneville in the forest of Mondon on November 9; meanwhile, Battery No. 1 had arrived at its firing position in the forest of Velaine via Champigneulles on November 6, the objective being Bensdorf. This latter position was about 20 miles east of the one occupied by Battery No. 2. The target assigned to Battery No. 2 was Saarburg. Both targets were important German railroad centers.

In this territory much more work in the preparation of the gun positions was necessary than at any other firing point tha

had been assigned. The soil was wet clay, and it was difficult to install the pit foundation. A track for bringing up the gun was not available, and it was necessary to fell trees and prepare the necessary road bed. The entire forest of Champenoux was alive with the preparation of gun emplacements and with the movement of troops preparatory to the great push. The greatest caution had to be taken in all movements of trains, for the Germans were continually opening up with their artillery at the least evidence of a locomotive or other vehicle of transportation. Batteries Nos. 1 and 2 were assigned to positions much nearer to the front lines than customary, and it was apparent from the tremendous array of field pieces, howitzers, mortars, and other weapons that the Allied command contemplated a very heavy movement due east in this sector, supported by the 3d, 7th, 8th and 10th French armies. The artillery in place, and the accumulation of mobile artillery in the rear exceeded all previous offensive preparations of the war, and with the veteran armies which were to make this thrust, it is quite apparent that had the armistice not gone into effect when it did, Metz would have been taken from both the north and the south, and the possible ending of the war would have occurred similar to the French surrender at Metz in 1870, only on a larger scale.

Battery No. 3 was shifted from Thierville to Battery No. 2's position at Charny, and on November 1 fired one round at the railroad yards of Longuyon, map range 38,380 yards. Battery No. 4 fired 23 rounds into Montmedy, map range, 37,370 yards, and Battery No. 5 fired 44 rounds at the transportation centers of Longuyon. Again, on November 2, Batteries Nos. 3 and 5 each fired 25 rounds at Longuyon, and Battery No. 4, 20 rounds at the railroads of Montmedy. On account of the enemy's activities at Louppy and Remoiville Battery No. 4 on November 3 fired 25 rounds on a large ammunition dump, and on the cross roads and bridges there. After firing six rounds at the lower railroad garage, at Montmedy, on November 4, Battery No. 4 again took up position at Thierville on account of the weakened condition of the pit, making it inadvisable to continue firing from this point. Battery No. 3 opened fire on Louppy and Remoiville on the morning of November 4, firing 44 rounds at the two targets; 12 rounds were also fired at Montmedy.

All of the firings above mentioned were intermittent, covering a period each day of 6 to 12 hours. In case of a contemplated advance the firing generally began two to four hours before the infantry attack.

To continue the enumeration of all the firings conducted by the United States naval railway batteries would be too tedious, and in order that the offensive measures that may be accomplished by even so small a number as five efficient, high-powered, long-range guns may be appreciated, a summary of their operations follows:

REPORT OF FIRING—BATTERIES NOS. 1 AND 2

Date	Battery	Gun position	Objective	No. of shots
Sept. 6	2	Rethondes.	Tergnier.	1
14	2	Fontenoy-Ambleny.	Beny-Loisy.	10
15	2	Fontenoy-Ambleny.	Beny-Loisy.	12
28	1	Soissons.	Laon.	47
30	1	Soissons.	Laon.	35
Oct. 2	1	Soissons.	Laon.	30
3	1	Soissons.	Laon.	19
9	1	Soissons.	Laon.	25
10	1	Soissons.	Laon.	43
11	1	Soissons.	Laon.	43
12	1	Soissons.	Laon.	43
10	2	Flavy-le-Martel.	Mortiers.	35
11	2	Flavy-le-Martel.	Mortiers.	35
12	2	Flavy-le-Martel.	Mortiers.	35
30	2	Charny.	Montmedy.	6
31	2	Charny.	Montmedy.	6
Nov. 1	2	Charny.	Montmedy.	43

REPORT OF FIRINGS—BATTERIES NOS. 3, 4 AND 5

Date	Gun	Range	Objective	Gun position	No. of shots
Oct. 23	3	38,380	Longuyon.	Thierville.	1
	4	38,470	Longuyon.	W. of Verdun.	1
	5	38,580	Longuyon.	W. of Verdun.	1
29	3	25,900	Mangiennes.	Thierville.	10
	4	25,990	Mangiennes.	Thierville.	10
	5	26,080	Mangiennes.	Thierville.	10
30	3	36,830	Av. Fld., Longuyon.	Thierville.	6
	4	39,340	Tunnel, Montmedy.	Charny.	6
	5	36,800	S. Longuyon.	Thierville.	6
31	3	36,830	Av. Fld., Longuyon.	Thierville.	6
	4	39,340	Tunnel, Montmedy.	Charny.	6
	5	36,800	S. Longuyon.	Thierville.	6
Nov. 1	3	38,380	Longuyon.	Thierville.	1

REPORT OF FIRINGS—BATTERIES NOS. 3, 4 AND 5—*Continued*

Date	Gun	Range	Objective	Gun position	No. of shots
Nov. 1	4	37,670	Garage, Montmedy.	Charny.	23
	5	38,580	Longuyon.	Thierville.	44
2	3	38,380	Longuyon.	Thierville.	25
	4	37,670	Garage, Montmedy.	Charny.	20
	5	38,580	Longuyon.	Thierville.	25
4	3	28,840	Louppy.	Charny.	27
	3	27,910	Garage, Remoiville.	Charny.	17
	3	36,850	Low. Garage, Mont.	Charny.	12
3	4		Louppy.	Charny.	12
	4		Garage, Remoiville.	Charny.	13
4	4	37,670	Low. Garage, Montmedy.	Charny.	6
5	3	36,850	Low. Garage, Montmedy.	Charny.	11
	3	38,200	Upp. Garage, Montmedy.	Charny.	39
7	3	38,520	Bridge, Montmedy.	Charny.	50
8	3	36,850	Low. Garage, Montmedy.	Charny.	6
9	3	36,850	Low. Garage, Montmedy.	Charny.	25
	4	25,990	Mangiennes.	Thierville.	10
	4	38,470	Longuyon.	Thierville.	10
	5	26,080	Mangiennes.	Thierville.	10
	5	38,580	Longuyon.	Thierville.	5
11	4	37,670	Longuyon.	Thierville.	5
	5	38,580	Longuyon.	Thierville.	5

The naval railway batteries fired a total of 782 rounds against the enemy. The guns were fired on 25 different days. There was no such thing as lightly and heavily engaged, and the guns did not engage the enemy. They were used for strategical purposes entirely, and fired at ranges between 30,000 and 40,000 yards. Other artillery, of which there was a great quantity, could accomplish with less expenditure of ammunition and expense all the results that were desired at the shorter ranges. The number of rounds fired at any one time or on one day was governed by the results which they desired to obtain.

The ammunition supply for guns to be used in the field of active operations should be measured entirely by the life of the gun. It was not believed that the accuracy of the 14-inch guns would be more than 300 rounds and the navy's provision for 300 rounds for each gun proved entirely adequate.

In plans for use of long-range weapons under the conditions as they existed on the Western Front, the experience of the United States naval railway batteries demonstrated that it is advisable

to provide spare mounts rather than to provide spare guns. All advices received by the Bureau of Ordnance while they were drawing up plans for the naval railway batteries was to the effect that as many as four guns should be available for each mount, the reason being given that the life of the guns was short and after operating only a few weeks it would be necessary to withdraw the mount and replace the worn-out gun with a new one. The actual operation of the batteries in the great war demonstrated that this policy is not an effective one, for repeatedly it happened that the mounts themselves narrowly escaped destruction by shell-fire and by bombs. The effect of these bombs, had the German control been more efficient, would have been the destruction of the mount, but it is believed that the gun itself would have remained practically intact. So the navy, while the batteries were operating in France, decided that it is advantageous in the operation of heavy guns to provide each gun with a mount and not to hold guns in reserve as spares.

Heavy guns of a long-range type cannot be replaced without excessive delay. The replacement cannot be made at the front, and in all cases it is necessary to remove the battery to some distance behind the lines, where a shop with ample crane facilities is available, and during this interval a gap is likely in the lines. The only solution, and the one which is believed to be the most effective and economical for the operation of railway mounts, is to build the entire unit complete without provision for spare guns, to operate on the front as many as possible at one time, and to hold in reserve another complete unit to replace whichever one may lose its accuracy or to withdraw it entirely when it has ceased to be effective.

No observation was obtained at any time while operating in the Verdun Sector, and the only way of obtaining any idea of the results of the firings was through the Intelligence Service. On November 5 the southern part of Montmedy was reported on fire, on November 11 a German prisoner reported that the firing on Montmedy had caused a great deal of damage, one shell landing in the yards and killing all the Germans in two coaches.

The railway batteries at Charny and Thierville did not operate with impunity. They were repeatedly shelled and bombed as was the case at Soissons. On October 30 Battery No. 2 reported

firing six rounds into Montmedy with a range of 37,382 yards, the first shot at 12.04 p. m., and the last shot at 12.29 p. m. The enemy at the time was shelling cross roads between the gun and the berthing cars. Three American engineers working on the track nearby were killed. The headquarters and one berthing car were derailed and replaced without damage. Battery No. 4, on the same day, reported five other soldiers killed and others injured by enemy shells which fell near the crossing of the roads (railway and wagon) at Charny. One shell which killed two and injured several others fell within 50 feet of the blue-jacket in the naval railway battery telephone control station. Gas masks were always carried and the men of the railway battery had to be continually prepared for casualties. When off duty the men remained in dugouts. On October 28 the following men of Battery No. 4 were wounded by enemy shell-fire:

GUTHRIE, K. W., S. F. 2C, U. S. N., wounded on left leg.
SHARPE, A. P., S. F. 1C, U. S. N. R. F., wounded on left leg.
BURDETT, A. J., S. F. 2C, U. S. N., wounded on face.

Two other men received slight wounds; Sharpe died on October 29 while in the hospital at Glorieux, near Verdun.

The importance of the targets under bombardment by the United States naval railway batteries is indicated by the following passages quoted from the secret field orders issued by Brigadier-General William Chamberlaine, U. S. A., Commanding Headquarters 30th Artillery Brigade (C. A. C.)

"October 18, 1918.

"The towns of Montmedy, Longuyon, Spincourt, and Conflans-en-Jarny are among the most important railroad centers of the enemy's transportation system for the supply of the Western Front."

"October 18, 1918.

"A group of long-range guns more powerful than heretofore assembled for a single operation is now being emplaced to attack the above centers.

"These centers will be attacked on the first day offering favorable observation. The object of this attack will be the destruction of the railroad yards and the rolling stock therein, the interruption of railroad traffic and the general disorganization of the enemy's transport system."

"October 18, 1918.

DETAILED INFORMATION CONCERNING TARGETS—LONGUYON

"Longuyon is an important railroad center, located at the junction of the lateral line from Alsace, through Metz and Thionville to the west and

the main line north through Luxemberg. Hirson-Sedan-Metz line is referred to in a recently captured German document as 'the most important artery of the Army of the West.' The cutting of this line would cripple the German steel production.

"Longuyon is a detraining point. The main railway yard contains 15 long sidings and is normally occupied by about 350 cars. Many of the houses in the town are destroyed, but there are numerous large storehouses in good condition."

MONTMEDY

"Montmedy is on the main railway line from Metz and Luxemberg to Sedan and Mezieres. The civil population, about 3000, is still in the town. The town has a citadel, large barracks, and is the headquarters of the 7th Germany Army. North of the town the railroad enters a tunnel about 800 meters in length. The railroad yard is large and frequently contains 400 cars. 1500 meters north of the town there is an aviation field which recently contained 7 hangars."

CIRCULATION

"Circulation on the line Conflans-Domary-Baron-Court-Spincourt averages one train per hour in each direction. This figure includes both civil and military trains. The greatest circulation is between 10 and 8 hours. Longuyon and Montmedy show considerable night activity."

After the signing of the armistice on November 11, Montmedy, Longuyon, Mangiennes, Louppy and Remoiville were visited, and some of the results of the firing were obtained from observation and from questioning the civilian population that remained. The guns apparently were firing a few hundred yards beyond the ranges calculated from the range table, but the damage to both material and morale was considerable. The targets were struck frequently, and the traffic was stopped completely, not only during the actual firing but from 6 to 10 hours each day after the firing had ceased. As the railroad running through Longuyon and Montmedy was the only line by which troops could be brought to Sedan other than a railroad running far to the north through Belgium, the cutting of this line was a strategical victory of great importance. General Pershing, in his report, states in his description of the last phase of the Meuse-Argonne offensive, "Our large-caliber guns had advanced and were skillfully brought into position to fire upon the important lines at Montmedy, Longuyon and Conflans—the strategical goal which was our highest hope was gained. We had cut the enemy's main line of communica-

tions and nothing but surrender or an armistice could save his army from complete disaster.[13]

All of the naval railway batteries were ordered back to the R. A. R. base, at Haussimont a few days after the armistice took effect, arriving there on November 22. On November 28 the staff train left Haussimont for St. Nazaire, via Paris, and the other trains followed, one per day, on the succeeding days. By December 11 all batteries had arrived at St. Nazaire. On the same day a draft of 150 men and six officers left for the United States through Brest. On December 13 and 17 the remainder of the personnel left St. Nazaire for the United States, via Brest, with the exception of one officer and 20 men, who were detailed to remain with the guns with orders to disassemble and ship them home at the earliest opportunity. Rear Admiral C. P. Plunkett, U. S. Navy; Lieut. Commander J. W. Bunkley, U. S. Navy, his executive officer while commanding the United States naval railway batteries, and a majority of the personnel of the railway batteries, arrived in New York on Christmas Eve, 1918, and the entire expedition would have been home before New Year's except that two or three officers and a number of men were so unfortunate as to be delayed when the *Northern Pacific,* on which they took passage, ran aground on Fire Island.

[13] Extracts from Confidential Bulletin No. 231, November 7, 1918, from Vice Admiral Sims, sent to Bureau of Ordnance by direction of the Chief of Naval Operations:

"The 14-inch 50-caliber United States naval railway guns have done very excellent and valuable work, particularly in the recent pushes. Three of these guns have been in the sector opposite Mezieres, and have had the railways to and from that place under effective gun fire for some time.

"The accuracy of these guns has proved greater than was expected. With a gun that had fired 150 rounds, 24 observed rounds were fired at a range of 35,800 yards. The mean dispersion obtained was plus or minus 151 yards in range, and plus or minus 51 yards in deflection. The ballistic correction in this case was about 2800 yards. The shots were fired about 5 minutes apart.

"Considering the relation of the total pattern size to mean dispersion in a salvo, it is estimated that these results would work out, in the case of a 12-gun salvo, to a pattern of about 650 yards in range and about 220 yards in deflection at 35,800, the guns being all considered as having fired about 150 times since proof. A careful analysis of the results obtained under existing conditions appears to indicate that a gun may shoot accurately while both muzzle erosion and considerable coppering exists."

Buell, Dexter C., Lieut. Commander, U. S. N. R. F., Construction Officer (detached September 30, 1918).

Hayden, Joseph R., Lieutentant, U. S. N. R. F., Train Commander, gunnery and orientation.

Smith, William G., Lieutentant, U. S. N., Train Commander, gunnery and orientation.

Martin, James A., Lieutenant, U. S. N., Train Commander, gunnery and orientation.

Rodgers, James L., Lieutenant, U. S. N. R. F., Train Commander, gunnery and orientation.

Duckett, Edmund D., Lieutenant (JG), U. S. N., Train Commander, gunnery and orientation.

Davis, Homer B., Lieutenant (JG), U. S. N. R. F., Assistant to Train Commander.

Orr, M. B., Lieutenant (JG), U. S. N. R. F., Assistant to Train Commander.

Grylls, Humphrey M. K., Ensign, U. S. N. R. F., Assistant to Train Commander.

Allen, Roger, Ensign, U. S. N. R. F., Assistant to Train Commander.

Raymond, Philip T., Ensign, U. S. N. R. F., Assistant to Train Commander.

Davis, Winfield C., Ensign, U. S. N. R. F., Gas Officer and Assistant to Train Commander.

Cheffy, George, Ensign, U. S. N. R. F., Assistant to Train Commander.

Davis, Parlett L., Ensign, U. S. N. R. F., Assistant to Train Commander.

Linhard, Leon J., Ensign, U. S. N. R. F., Assistant to Train Commander.

LeBlanc, Thomas J., Ensign, U. S. N. R. F., Transportation Officer.

Primeau, Albert K., Ensign, U. S. N. R. F., Assistant to Train Commander.

Baldwin, Frank, Lieut. Commander (Pay Corps), U. S. N., Paymaster and Supply Officer.

Stephenson, C. S., Lieut. Commander (Med. Corps), U. S. N., Senior Medical Officer and Gas Officer.

Morris, Laird M., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Bugbee, Edwin P., Lieutenant (Med. Corps), U. S. N. R. F., Junior Medical Officer and Gas Officer.

Field, Thomas S., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Andrews, E. D., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Carr, George P., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Eubank, Gerald L., Ensign (Pay Corps), U. S. N. R. F., Assistant to Supply Officer.

Gaffney, Francis L., Ensign (Pay Corps), U. S. N. R. F., Assistant to Supply Officer.

Anderson, Oscar E., Pay Clerk, U. S. N. R. F., Assistant to Supply Officer.

tery No. 2, when firing this first shot from the naval railway battery in France against the Germans, occupied the same position as occupied by the train carrying General Foch and his staff at the time the armistice was signed later on November 11, 1918.

There was continuous demand for the American naval guns; so, as soon as they had concluded their firing at one point they received orders to proceed to another. Battery No. 1 went from

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the town. As the gun was loaded, however, they let us fire it. The sand packing behind the back timbers had not been very well done in this pit, so it came back one-half inch. This would not have been serious, but we profited by it in subsequent installations. We never learned where the shot fell, but I think it went its 41,000 yards all right, and that it was the longest range shot that had so far been fired at the Germans.

"Then they moved us up the track at night to a place called Fontenoy. They have lots of air raids and bomb the tracks, so that at least every 100 yards has at some time been hit and repaired. There was an air raid just before we started which cut all the telephone lines, and we had to crawl along slowly to see whether the track had been cut, and to get permission from each station to proceed to the next. Fontenoy was in the hands of the Germans during the last push. Our target there was an ammunition dump at about 38,600 yards. The first time we fired we got off two rounds, but the plane could not see them. There were woods near the target, so we changed the range of the second 1000 yards to get it out in the open. Still the aviator could not see it and he ran out of gasoline. We had to wait for another occasion because of bad weather, but then got hurry-up orders to fire 10 rounds without observation. We do not know how we came out on this, but they could hear us all over the front. Four of the observation balloons in front of us were burned down in two days. They could not have seen our shots anyway, however.

"The next day we tried an observation shot again and could pick up nothing for the first two rounds. The aviator spotted from a height of 6000 meters and had a gale of about 90 kilometers an hour, blowing him towards the German line. He got his hand and his face frozen. On the third round, he saw our burst about 1000 yards to the left. I had jacked over about 600 yards when we got the signal to fire again, so let it go at that, and was given OK in direction, but 1300 yards over. We were firing purposely 1000 yards beyond to register in a clear spot, if possible. On the next round, I brought it down 1300 yards and left the direction unchanged. He reported that he could not see the bursts well at all from this height, but is sure that we hit some ammunition on the third round. We were told to finish out our 10 rounds, so we shot the last seven rapidly. We knew we were on in direction and were 1300 yards over while intending to be 1000 over, so we felt quite pleased with the probable accuracy of the estimated range of the remainder. The last seven shots (six intervals) we got off in 25 minutes."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

Prize Essay, 1917[1]

COMMERCE DESTROYING IN WAR

By CAPTAIN L. A. COTTEN, U. S. Navy

Motto: Easy methods; inconsiderable results.

The science of war as we know it to-day, like all other sciences, is the result of progressive development. As war implements changed by successive stages from the clubs and stones of savagery to the high-power guns of to-day the method of using these implements necessarily changed also, but the object of war has constantly remained the same, namely the reduction of one's opponent to such a state of impotence, actual or prospective, that he considers it the part of wisdom to submit to the will of his enemy.

Since war ceased to be a general *mêlée in* which one savage tribe fell upon another and fought by brute force until one was exterminated or enslaved, man has been more and more seeking to employ his brains as an aid in fighting. Many have reaped the advantage of more effective weapons or a more effective use of their weapons, but many more have striven in vain for a short cut to success in war—some patent nostrum by which victory could be won without taking and giving the hard blows that make war so disagreeable.

In the early ages of human development, sea-borne commerce was practically non-existent, but, so soon as civilization reached the era of colonization, it quickly became an important part of the economic life of the countries that faced the sea, and consequently of great importance in war.

A merchant vessel on the high-seas is particularly helpless to resist force, and furthermore constitutes, with her cargo, a con-

[1] Essay received by U. S. Naval Institute, December 30, 1916. Published without change.

centrated form of wealth. The sea offers no facilities for concealment, and the lanes of maritime commerce converge in certain localities on account of physical features, as islands, straits or smaller seas, making the location of merchant ships fairly simple. Seeing this, some seeker for success-in-war-without-fighting evolved the idea of commerce destroying as the long-sought short cut to easy, economical and successful war.

He argued in this way. We will build ships of less cost than heavy men-of-war, and send them out to prey upon this helpless maritime wealth of our enemy. These ships will infest the regions in which his merchant ships converge, and by capturing or destroying them we will bring him to the verge of bankruptcy, at the same time enriching ourselves at his expense. This reasoning seemed plausible, and this means of winning war on the sea appeared to be both simple and economical, and straightway there arose a school of adherents, both naval and civilian, though it must be said that it always appealed with more force to those who *direct* the conduct of war than to those who actually have to execute it. In any case, from that day to this, most maritime wars have seen commerce destroying used with varying degrees of insistence.

That great student of naval history, Admiral Mahan, said: "There are certain teachings in the school of history which remain constant," and it would seem to be not without interest to see what lessons the school of history contains on commerce destroying in war, with special attention to its final result and its association with victory or defeat. Such lessons should be of particular interest at this time, when commerce destroying is being undertaken on an extensive scale and a new instrument, the submarine, is being employed in its service.

A survey of the history of commerce destroying will necessarily have to be very brief to be compassed in reasonable space, but even so, we may be able to deduce something therefrom of value to our country and of interest to ourselves. Such a survey may be divided logically into two parts, *i. e.*, commerce destroying in former wars and commerce destroying in the present war. By handling the subject in this way we may more accurately gauge the present by the known results of the past, and after all, such a survey can have real value only in so far as it leads to a clearer understanding in the momentous present.

It is not necessary for our purpose that we go back in history for a further period than to enable us to cite sufficient examples upon which to base our deductions with reasonable safety. By the middle of the sixteenth century maritime commerce had risen to a position of great economic importance in the national lives of several European countries, particularly Spain. Her galleons usually voyaged several together, the better to defend themselves from the pirates and freebooters of that day, and on their homeward voyages were laden with cargoes of great value.

When England under Elizabeth and Spain under Philip went to war, partly for "the glory of God," and partly for the privilege of trade with America, the Spanish Navy was at the height of its glory, while the English Navy had yet to win its distinction, and to become imbued with those correct principles of naval warfare that for so long have maintained England in her world position. At this time England was a comparatively poor country, and first-line men-of-war were expensive, so for some years she made direct war on the commerce of Spain her chief objective, at the same time pillaging and destroying her colonial cities as occasion permitted.

At first this mode of warfare seemed to meet with considerable success, but, none-the-less, when Philip began building and fitting out a vast number of fighting ships, England found herself threatened with invasion, *which commerce destroying was powerless to stop.* Though Drake covered himself with glory when he "singed the King of Spain's beard for him" at Cadiz, the preparations for invasion were only delayed, not stopped.

After much delay through vacillation and economy, the English began to prepare a fighting fleet, and finally were able, though vastly outnumbered, to "defy the Duke Medina" and scatter to the winds the Great Armada.

Then it was that the English found that in saving England from invasion *by destroying the Spanish war-fleet,* they had also greatly simplified the problem of trade with America, and had put the commerce of Spain almost at their mercy.

For fifty years or more after this, England put her reliance in maritime war in her fighting fleet; but plausible fallacies die hard, and in the second Anglo-Dutch war the English showed they had only half-learned their lesson. Charles II, as usual, was short of

money and, besides, the war was waged primarily over the question of maritime commerce, so again England made direct war on commerce, though several fleet actions took place. In these actions the English Navy, while winning no decisive victories, still maintained its position very satisfactorily. After the battle off the North Foreland, Charles, for purposes of economy, decided to put most of his fighting ships out of commission, and concentrate upon commerce destroying. The ineffectiveness of such action may be clearly seen, since the Dutch fleet entered the Thames River in 1667 and inflicted enormous damage, and England was quite willing to come to terms of peace containing no advantages for herself, except escape from the then vastly superior Dutch fleet.

England wholly learned her lesson this time, and not since the Peace of Breda, signed after De Ruyter's raid up the Thames, has she used commerce destroying as a primary mode of maritime war. On the contrary her own commerce has been attacked directly a number of times, but nevertheless it has continued to grow until it has become greater than that of any other country.

France has been the most faithful adherent of commerce destroying, having used it intermittently in her naval wars for over a hundred years. Over and over again it was demonstrated that it led to no considerable military advantage, but still she clung to it with a tenacity worthy of a better cause.

In the third and last Anglo-Dutch war, in which France was allied with England, each of the powers used their fighting fleets, rather than commerce destroying, and finally the Dutch sea power was destroyed and with this destruction Dutch commerce was *automatically* toppled from its pedestal of supremacy.

Again, in the War of the League of Augsburg, we see France taking the sea with fighting fleets and England, now allied with the Dutch, was partially defeated at the Battle of Beachy Head, though the next year Admiral Russell took the sea with a greater force than Tourville could gather. However, by skillfully handling his fleet Tourville drew the English fleet well out into the Atlantic, and during its absence the French light cruisers fell upon English commerce and inflicted enormous damage.

During this campaign, it should be noted, there was no actual fighting, and yet the injury to England was considerable. Here we probably have the origin of the French belief in the efficacy of

commerce destroying as a primary mode of warfare on the sea. "Why," they argued, "have expensive fighting fleets when such injury can be done our enemy by cheaper cruisers and privateers." They quite overlooked the fact that their main fleet, by drawing off the English fleet in pursuit, gave to their cruisers the temporary immunity that enabled them to operate successfully.

The following year the French fleet was badly worsted at La Hogue, but direct war on commerce was continued on a scale previously unknown. Gradually, though, as the French Navy declined in fighting ships, their commerce destroyers were chased from the seas, and with sea control in England's hands French maritime commerce disappeared and its place was taken by England's increasing fleet of merchant vessels. As the disparity in fighting ships increased it became progressively more dangerous for the French commerce destroyers to go to sea, and more difficult for them to make captures even when they could keep the sea.

The part of a commerce destroyer is to destroy merchant vessels, not to fight, and consequently French commerce destroyers were usually so busy keeping out of the way of English men-of-war that they had but little opportunity to ply their vocation. Where the lanes of commerce converged, and captures should have been easy, England stationed men-of-war more powerful than commerce destroyers and the French ships had to seek their victims in more sparsely traversed regions, where captures were few. The peace terms were most humiliating to Louis XIV, and his comparatively successful war on commerce was in no way comparable to the *military* success on the sea of his enemy.

When the war of the Spanish Succession began France at first tried squadron warfare in rather a half-hearted way, but the ease and seeming economy of war on commerce again lured her away from the true principles of naval warfare. During the first five years of the war France captured or destroyed on an average about 230 English ships per year, but England captured more French ships during that time, though her fleet was primarily engaged in military operations that were not without great influence in leading up to the treaty of Utrecht, so disastrous to France. The individual exploits of some of the French privateering commanders were illustrious, but none-the-less the end of the war found France

humbled and defeated and English sea power with its protecting wing at its height.

In the war of the Austrian Succession the naval history of the war of the Spanish Succession in effect repeated itself. France started off as though to fight her part in the war on the sea, but soon commerce destroying was again the accepted mode and the treaty of Aix-la-Chapelle in 1748 restored to France none of the concessions made by the treaty of Utrecht.

In the Seven Years' War between France and England we see another deplorable result of seeking an easy mode of warfare, for though the French fought on occasion, they were ever on the defensive—always willing to await the attack of their enemy—rather than seeking in aggressive action to deliver the heavy blows necessary to overcome an enemy, even if heavy blows have to be accepted in doing so. They seem to have thought that by making a *pretence* of fleet warfare they could impart the element needed to make commerce destroying effective as a means of bringing their enemy to terms.

It is quite true that England suffered the loss of many merchant vessels, but French commerce was practically denied the use of the sea by the English fleets, and, after all, the percentage of loss to the English was small. Her ships were now carrying both her own normal commerce and that abandoned by France. The financial loss to England was scarcely more than a small war tax upon maritime commerce, never amounting to more than 3 or 4 per cent per year. In the meantime England was taking the French colonies one by one, far more than compensating herself in a financial way for the small war tax, and at the same time establishing the foundation of the British Empire.

The treaty of Paris in 1763 left in English hands Canada, Nova Scotia, the Ohio valley, the country east of the Mississippi to New Orleans and numerous small West Indian islands, and *a navy powerful enough to keep them*. The practical results of France's war on English commerce were absolutely without effect when it came to signing the treaty of peace. Comment is unnecessary.

In the maritime part of the War of the American Revolution, France swung away from war on commerce and rather consistently followed squadron warfare, but the infection of non-aggressive action was still there as a legacy from the less rigorous

mode of warfare. Still the results of the war were much more satisfactory to France than were those in which war on commerce had been accorded a more prominent part.

It is nothing short of remarkable that the French, after their years of failure to attain any material advantage through war on commerce, should again revert to it, yet they did no less. In the French Revolution the Committee of Public Safety announced "The new system of political warfare that your committee has adopted. . . . All our plans, all our cruises, all our movements in port and at sea, will have for object only to ravage its (England's) commerce, to destroy, to overturn its colonies, to force it finally into a shameful bankruptcy." That this system was termed new, can only be attributed to an utter lack of familiarity with naval history in general and with French naval history in particular.

It cannot be denied that for some years many English merchant ships were captured, and it was doubtless a source of annoyance to English merchants, but the monetary value of these ships was but a very small part of the total expense of war, and during these years, despite captures, English commerce actually increased. The "shameful bankruptcy" failed to materialize. As a matter of fact the French captures per year averaged only from 2.5 to 3.0 per cent of England's merchant fleet, which does not seem a very heavy war tax.

In the Napoleonic Wars, the French, though their military operations were directed by a master mind, still hoped to gain some advantage through war on commerce at sea. They fought several memorable fleet actions, it is true, but they were always the attacked, and it would seem as though the hearts of their seamen were ever longing for some less violent form of warfare, some easy mode of success, some method of "making war without running risks," as Napoleon himself said. For several years after Trafalgar, war on commerce was followed with energy and persistence, but one by one the French cruisers were sunk, captured or wrecked, and their own shipping, lacking the protecting influence of fighting squadrons, practically disappeared from the high seas.

The numerous examples from French history have been cited, because for a hundred years there were practically only two naval powers, and their modes of conducting warfare were diametrically

opposite. England, profiting by the lessons learned from her wars with Spain and Holland, took the sea, whether inferior or superior in numbers, ready and eager to fight, and her objective was ever the fleet of her enemy. France over and over again sought by inconclusive maneuvers and commerce destroying to bring her enemy to terms. The known results of the various wars individually, and the cumulative total of a hundred years, illustrate more clearly than mere words may hope to do, the strength of the one method and the weakness of the other. It may be accepted as a maxim of warfare that what is worth having is worth fighting for, and easy methods lead to inconsiderable results.

Only a few more examples of commerce destroying prior to the present war will be mentioned, and these only because being less remote historically, they are more generally familiar, and because one famous example of war on commerce is of particular interest to Americans.

During our Civil War the South, having but few men-of-war, used them largely in warring upon the sea-borne commerce of the North. Three ships, the *Florida,* the *Shenandoah* and the *Alabama,* were particularly successful, but the importance of their operations has been vastly magnified by the romantic appeal of their careers, and the concurrent decline in American shipping that has lasted to the present time.

The *Alabama* was the most celebrated of these commerce destroyers, and yet she averaged only three captures per month, and the total loss by capture of the commerce of the North during the entire war, according to a congressional investigation made soon thereafter, was only 5 per cent of the whole, or 1¼ per cent per year. This does not impress one as being an exorbitant war tax on any branch of commerce. That these commerce destroyers were able to accomplish even as much as they did was due more to faulty methods of commerce protection on the part of the North, than to any inherent value in this mode of warfare.

While the commerce of the North was very seriously injured by the direct attack upon it, it is generally lost sight of that the commerce of the South was practically prohibited on the high seas by the purely military disposition of the Northern fleet. That this military disposition was a most effective factor in defeating the South, no one familiar with the history of the Civil War can doubt. At the same time it is highly improbable that the total result of

the Southern commerce destroyers prolonged the losing struggle of the Confederacy by so much as one day, nor would the result of the war have been different had there been a hundred *Alabamas* —so long as they were used purely as commerce destroyers.

The permanent decline of American maritime commerce was due much less to commerce destroying than to legislative, economic and fiscal causes subsequent to the war.

In the Spanish-American War neither combatant had a merchant fleet worthy of the name, and so it affords no examples of war on commerce, though our men-of-war, of course, captured such Spanish merchant ships as came their way. The war was in effect concluded by the destruction of the Spanish fighting squadrons at Manila and Santiago.

In the Russo-Japanese War the Russian division based on Vladivostok made several raids on Japanese commerce, in one case getting as far down as the entrance to Tokyo Bay, but the influence of these raids on the final result of the war was absolutely nil. The Japanese refused to draw any part of their main fleet away from their strictly military objective—the Russian fleet of fighting ships in Port Arthur.

Even in this mere outline sketch of commerce destroying in past wars, it may be seen that certain facts repeat themselves with such consistency that we can but conclude that they belong to the constant teachings in the school of history. We see that commerce destroying has ever been used by the nation having the weaker navy—weaker in fighting ships, in morale, or in the willingness to run the legitimate risks of normal war on the sea; that the main incentives to such warfare are economy and the longing for an easy way to success in war; that the surest way of accomplishing the ruin of an adversary's commerce is to destroy the fighting force that protects it, rather than to make direct war on commerce; that commerce attacked directly sometimes actually increases in war, when protected by adequate fighting ships properly used; that, at its best, commerce destroying has been able to inflict no more than a small percentage of loss on an enemy's total maritime commerce; that the monetary loss to an enemy caused by attacking her merchant ships has never amounted to more than a very small fraction of the cost of war; that an enemy country has never been brought to the verge of bankruptcy through attacking its commerce; that war on commerce has never produced

concrete results of moment tending to reduce an adversary to a state of impotence; and finally that commerce destroying has consistently been practiced by the nation that was, sooner or later, defeated in the essentials of the wars in which this form of warfare was employed.

It is hardly within the bounds of reason that the foregoing clearly discernible facts should have been merely coincidental. There must be some reason for the results, and when these results are similar again and again this reason must be fairly constant, if not fundamental. The results in war are after all the essential things, and when a mode of warfare fails to produce results the reasons for its adoption cease to be of particular interest.

So it is beside the question to advocate commerce destroying in war on account of its original economy, for on the whole its operation is very uneconomical, looking at the war as an entity rather than as a number of parts; it is of no moment to state that war on commerce will reduce an enemy to bankruptcy, since it has never done so; it is futile to the extreme to employ such warfare hoping to win victory thereby, since the history of a hundred and fifty years and more show it to have been ever associated with defeat.

It is not intended that the conclusion is to be drawn that the final results of the various wars were absolutely determined by the types of naval warfare employed, but beyond question the successful use of sea power did have a great influence in each case, and direct war on commerce does not seem to be the most advantageous use of sea power. Since the war is conducted by force it must be terminated by the destruction of force, and so far no easy method of accomplishing this has been evolved.

War on commerce has its uses, for it annoys and weakens an enemy, but as a primary, peace-compelling undertaking it does not produce military advantages of importance. The best way for a combatant nation to protect its own commerce and at the same time drive the commerce of its enemy from the sea, is to destroy the fighting ships of that enemy. That much is certainly tr we are to accept the lessons of history up to the present time we are safe in assuming that it will remain true until basic c tions have changed or some new method or instrument in merce destroying is utilized that fundamentally changes the problem.

tions and nothing but surrender or an armistice could save his army from complete disaster.[30]

All of the naval railway batteries were ordered back to the R. A. R. base, at Haussimont a few days after the armistice took effect, arriving there on November 22. On November 28 the staff train left Haussimont for St. Nazaire, via Paris, and the other trains followed, one per day, on the succeeding days. By December 11 all batteries had arrived at St. Nazaire. On the same day a draft of 150 men and six officers left for the United States through Brest. On December 13 and 17 the remainder of the personnel left St. Nazaire for the United States, via Brest, with the exception of one officer and 20 men, who were detailed to remain with the guns with orders to disassemble and ship them home at the earliest opportunity. Rear Admiral C. P. Plunkett, U. S. Navy; Lieut. Commander J. W. Bunkley, U. S. Navy, his executive officer while commanding the United States naval railway batteries, and a majority of the personnel of the railway batteries, arrived in New York on Christmas Eve, 1918, and the entire expedition would have been home before New Year's except that two or three officers and a number of men were so unfortunate as to be delayed when the *Northern Pacific,* on which they took passage, ran aground on Fire Island.

[30] Extracts from Confidential Bulletin No. 231, November 7, 1918, from Vice Admiral Sims, sent to Bureau of Ordnance by direction of the Chief of Naval Operations:

"The 14-inch 50-caliber United States naval railway guns have done very excellent and valuable work, particularly in the recent pushes. Three of these guns have been in the sector opposite Mezieres, and have had the railways to and from that place under effective gun fire for some time.

"The accuracy of these guns has proved greater than was expected. With a gun that had fired 150 rounds, 24 observed rounds were fired at a range of 35,800 yards. The mean dispersion obtained was plus or minus 151 yards in range, and plus or minus 51 yards in deflection. The ballistic correction in this case was about 2800 yards. The shots were fired about 5 minutes apart.

"Considering the relation of the total pattern size to mean dispersion in a salvo, it is estimated that these results would work out in the case of a 12-gun salvo to a pattern of about 650 yards in range and about 200 yards in deflection at 35,800, the guns being all considered as having fired about 150 times since proof. A careful analysis of the results obtained under existing conditions appears to indicate that a gun may shoot accurately while both muzzle erosion and considerable coppering exists."

If financial loss be made sufficiently great and sufficiently widespread to bring suffering or extreme deprivation upon many individuals it may have military effect by damping the general zeal for war or even by arousing a willingness to make great concessions for peace. In the case of the financial losses here considered, we have seen that the very interests that suffer the losses are the ones that to a certain degree have these losses compensated. In this age maritime losses are very generally distributed by means of insurance, and there are no indications of real suffering brought on by maritime losses at sea.

The effect of this form of warfare on the morale of those practicing commerce destroying is, of course, speculative, but it is highly probable that a navy that systematically practices war on defenceless merchant ships almost exclusively for any length of time will deteriorate in those characteristics that distinguish virile, courageous, manly naval personnel. When the French Navy was for so long practicing direct war on English commerce, the morale of her navy was at its lowest ebb. That this was not racial is at once apparent when we recall that during this same time the morale of the French army was above reproach.

We know that heroic action develops the capacity for heroic action, and the development of military character is very largely dependent upon the nature of the service one is required to render.

Though possibly not strictly within the scope of our inquiry, it may be of interest to note that friction with neutrals is one of the historic corollaries of war on commerce. It is not difficult for one warring on the commerce of an enemy to convince himself that an occasional attack on a neutral will produce results of benefit to his country, and such attack is so *easy*, and resistance so futile. Of course, such attacks may be of use in specific instances, but the resulting resentment of the neutral, if nothing more, is bound to react to the advantage of his enemy, particularly if that neutral is of importance in the family of nations. Especially in this day the good will of neutrals is an asset of considerable importance to a belligerent, and war on commerce is a very likely way of alienating such good will.

NOTE.—Various naval authors have been consulted in preparing the first part of the above, particularly Mahan, Darrieus, Daveluy, Corbett Thursfield.

The last shot from the United States naval railway batteries was fired by Battery No. 4, from its position at Charny. This shot was fired at 10.59 a. m., into Longuyon by James A. Kaffka, S. F., 1st class, U. S. Navy, who energized the firing key and caused the primer to function. This primer is now in the possession of Rear Admiral Earle, chief of Bureau of Ordnance. A copy of Marshal Foch's letter terminating hostilities follows because of its historical interest.

VIII^e ARMÉE

État-Major

3^{me} Bureau

N° 8272 NOTE DE SERVICE

Le Maréchal FOCH télégraphie ce qui suit:

" Maréchal FOCH à Commandants en Chef:

" 1°/.. Les hostilités seront arrêtées sur tout le front à partir du 11 (ONZE) NOVEMBRE, 11 (Onze) heures (heure française).

" 2°/.. Les Troupes Alliées ne dépasseront pas jusqu'à nouvel ordre la ligne atteinte à cette date et à cette heure."

Copie conforme notifiée pour exécution.

P. O. Le Chef d'État-Major,
DOUCHY.

VIII^e ARMÉE
Artillerie
R. G. A.
N° 6122 Notifié à: B^n Naval Américain N° 1.

Le 11 Novembre, 1918,
Le Général Cdt. l'Artillerie de l'Armée,
P. O. LE CHEF D'ESCADRON R. G. A.
MERCUEILLIN.

LIST OF OFFICERS ATTACHED TO U. S. NAVAL RAILWAY BATTERIES

*Plunkett, Charles P., Rear Admiral, U. S. N., Commanding.

Schuyler, Garret L., Commander, U. S. N., Ordnance, gunnery and orientation.

Bunkley, Joel W., Lieut. Commander, U. S. N., Executive, gunnery and orientation.

Buell, Dexter C., Lieut. Commander, U. S. N. R. F., Construction Officer (detached September 30, 1918).

Hayden, Joseph R., Lieutentant, U. S. N. R. F., Train Commander, gunnery and orientation.

Smith, William G., Lieutentant, U. S. N., Train Commander, gunnery and orientation.

Martin, James A., Lieutenant, U. S. N., Train Commander, gunnery and orientation.

Rodgers, James L., Lieutenant, U. S. N. R. F., Train Commander, gunnery and orientation.

Duckett, Edmund D., Lieutenant (JG), U. S. N., Train Commander, gunnery and orientation.

Davis, Homer B., Lieutenant (JG), U. S. N. R. F., Assistant to Train Commander.

Orr, M. B., Lieutenant (JG), U. S. N. R. F., Assistant to Train Commander.

Grylls, Humphrey M. K., Ensign, U. S. N. R. F., Assistant to Train Commander.

Allen, Roger, Ensign, U. S. N. R. F., Assistant to Train Commander.

Raymond, Philip T., Ensign, U. S. N. R. F., Assistant to Train Commander.

Davis, Winfield C., Ensign, U. S. N. R. F., Gas Officer and Assistant to Train Commander.

Cheffy, George, Ensign, U. S. N. R. F., Assistant to Train Commander.

Davis, Parlett L., Ensign, U. S. N. R. F., Assistant to Train Commander.

Linhard, Leon J., Ensign, U. S. N. R. F., Assistant to Train Commander.

LeBlanc, Thomas J., Ensign, U. S. N. R. F., Transportation Officer.

Primeau, Albert K., Ensign, U. S. N. R. F., Assistant to Train Commander.

Baldwin, Frank, Lieut. Commander (Pay Corps), U. S. N., Paymaster and Supply Officer.

Stephenson, C. S., Lieut. Commander (Med. Corps), U. S. N., Senior Medical Officer and Gas Officer.

Morris, Laird M., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Bugbee, Edwin P., Lieutenant (Med. Corps), U. S. N. R. F., Junior Medical Officer and Gas Officer.

Field, Thomas S., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Andrews, E. D., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Carr, George P., Lieutenant (Med. Corps), U. S. N., Junior Medical Officer and Gas Officer.

Eubank, Gerald L., Ensign (Pay Corps), U. S. N. R. F., Assistant to Supply Officer.

Gaffney, Francis L., Ensign (Pay Corps), U. S. N. R. F., Assistant to Supply Officer.

Anderson, Oscar E., Pay Clerk, U. S. N. R. F., Assistant to Supply Officer.

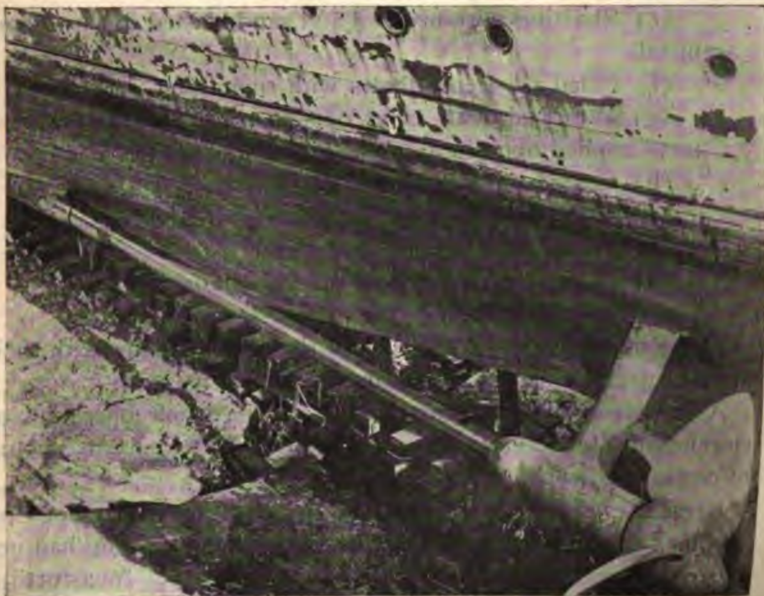

FIG. 2.

FIG. 3.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

BALL BEARINGS

By Lieut. Commander H. D. McGuire, U. S. Navy

PREFACE

"Where do we go from here?" is an expression characteristic of what we of the navy subconsciously are asking ourselves as life unrolls its phase of duties ashore and afloat. Very often we must unceremoniously change from an operating to a designing engineer. Naturally, in such changes we find "nuts to crack." If they are covered by good technical writings we are fortunate; if not, it's a case of dig. That's when we wish some one had blazed the trail with some notes, no matter how meager.

Duty, not long ago, brought me face-to-face with the necessity of determining upon the type of ball bearing to choose for certain high-speed instruments. This was the "nut to crack." From notes made in the investigation of the subject, certain general principles, upon which the theory of ball bearings depends, became apparent, and these are presented in the following paragraphs.

It is understood in a general way that the purpose of the ball bearing is to reduce friction. What else we may expect of it is rather hazy. If the question is asked, "Why are there different types of bearings?", can we answer intelligently? What would be the answer to these questions with reference to ball bearings for a certain machine?

1. Size of bearing required.
2. Type of bearing.
3. Accuracy of bearing.
4. Kind of lubricant.
5. Methods of lubrication.

money and, besides, the war was waged primarily over the question of maritime commerce, so again England made direct war on commerce, though several fleet actions took place. In these actions the English Navy, while winning no decisive victories, still maintained its position very satisfactorily. After the battle off the North Foreland, Charles, for purposes of economy, decided to put most of his fighting ships out of commission, and concentrate upon commerce destroying. The ineffectiveness of such action may be clearly seen, since the Dutch fleet entered the Thames River in 1667 and inflicted enormous damage, and England was quite willing to come to terms of peace containing no advantages for herself, except escape from the then vastly superior Dutch fleet.

England wholly learned her lesson this time, and not since the Peace of Breda, signed after De Ruyter's raid up the Thames, has she used commerce destroying as a primary mode of maritime war. On the contrary her own commerce has been attacked directly a number of times, but nevertheless it has continued to grow until it has become greater than that of any other country.

France has been the most faithful adherent of commerce destroying, having used it intermittently in her naval wars for over a hundred years. Over and over again it was demonstrated that it led to no considerable military advantage, but still she clung to it with a tenacity worthy of a better cause.

In the third and last Anglo-Dutch war, in which France was allied with England, each of the powers used their fighting fleets, rather than commerce destroying, and finally the Dutch sea power was destroyed and with this destruction Dutch commerce was *automatically* toppled from its pedestal of supremacy.

Again, in the War of the League of Augsburg, we see France taking the sea with fighting fleets and England, now allied with the Dutch, was partially defeated at the Battle of Beachy Head, though the next year Admiral Russell took the sea with a greater force than Tourville could gather. However, by skillfully handling his fleet Tourville drew the English fleet well out into the Atlantic, and during its absence the French light cruisers fell upon English commerce and inflicted enormous damage.

During this campaign, it should be noted, there was no actual fighting, and yet the injury to England was considerable. Here we probably have the origin of the French belief in the efficacy of

commerce destroying as a primary mode of warfare on the sea. "Why," they argued, "have expensive fighting fleets when such injury can be done our enemy by cheaper cruisers and privateers." They quite overlooked the fact that their main fleet, by drawing off the English fleet in pursuit, gave to their cruisers the temporary immunity that enabled them to operate successfully.

The following year the French fleet was badly worsted at La Hogue, but direct war on commerce was continued on a scale previously unknown. Gradually, though, as the French Navy declined in fighting ships, their commerce destroyers were chased from the seas, and with sea control in England's hands French maritime commerce disappeared and its place was taken by England's increasing fleet of merchant vessels. As the disparity in fighting ships increased it became progressively more dangerous for the French commerce destroyers to go to sea, and more difficult for them to make captures even when they could keep the sea.

The part of a commerce destroyer is to destroy merchant vessels, not to fight, and consequently French commerce destroyers were usually so busy keeping out of the way of English men-of-war that they had but little opportunity to ply their vocation. Where the lanes of commerce converged, and captures should have been easy, England stationed men-of-war more powerful than commerce destroyers and the French ships had to seek their victims in more sparsely traversed regions, where captures were few. The peace terms were most humiliating to Louis XIV, and his comparatively successful war on commerce was in no way comparable to the *military* success on the sea of his enemy.

When the war of the Spanish Succession began France at first tried squadron warfare in rather a half-hearted way, but the ease and seeming economy of war on commerce again lured her away from the true principles of naval warfare. During the first five years of the war France captured or destroyed on an average about 230 English ships per year, but England captured more French ships during that time, though her fleet was primarily engaged in military operations that were not without great influence in leading up to the treaty of Utrecht, so disastrous to France. The individual exploits of some of the French privateering commanders were illustrious, but none-the-less the end of the war found France

$W = \frac{1}{4}\pi d^2 S^2 \div E.$

$d = 2\sqrt{WE \div \pi S^2}.$

S = Maximum safe unit stress of material.

d = Diameter of ball.

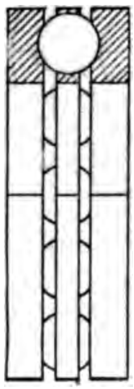
E = Modulus of elasticity.

W = Load.

The strength of a bearing can be increased by increasing the number of rows of balls.

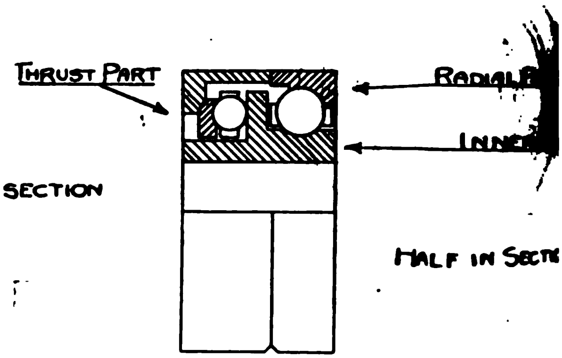
TYPES OF BEARINGS

Ball bearings are of many types, each of which has its champions to sing its praises. There are certain sound reasons



THRUST BEARING

SKETCH 3.



COMBINED RADIAL AND THRUST BEARING

SKETCH 4.

why there are different designs or types of ball bearings. These may be enumerated as follows:

1. Duties.
2. Method of assembly.
3. Method of ball spacing.
4. Method of alignment.
5. Number of rows of balls.

DUTIES

The following is the division made according to duties, viz.:

(a) Radial bearings. (See Sketch 2.)

(b) Thrust bearings. (See Sketch 3.)

(c) Combined radial and thrust bearings. (See Sketch 4.)

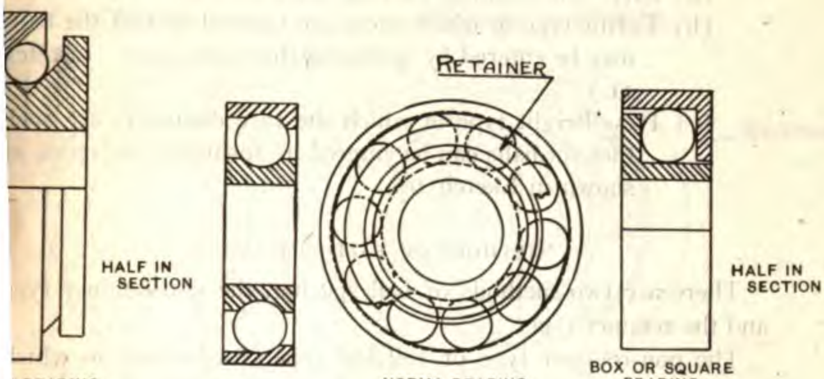
In radial bearings there can be a slight variance in size of balls, depending on the accuracy required.

In thrust bearings, variance 0.001″ or above in ball diameter seriously affects the bearing, because the whole load is taken up by the large ball, tending to fracture the races at point of contact. Careful selection of balls is consequently essential in this type of bearing.

METHOD OF ASSEMBLY

The following divisions are made according to method of assembly, viz.:

(a) The open type.
(b) The closed type.



ETCH 5.

NORMA BEARING
SKETCH 6.

SKETCH 7.

The open type bearings are of several kinds, with the principal differences in refinements of retainers, races, etc. The general divisions of this type are:

(a) The box or square bearings, as shown in Sketch 7.
(b) The cone bearing, as shown in Sketch 5.
(c) The retainer bearings, as typified by the Norma bearing. (See Sketch 6.)

The closed type are of several kinds, the difference being in method of filling balls in races. The general divisions under this type are:

(a) Slotted (interrupted race), and
(b) Non-slotted type (uninterrupted race).

The slotted types (interrupted race) are of two kinds, viz.:

(a) One race slotted. (Sketch 9.)

(b) Both races slotted. (Sketch 8.)

These types may be either full ball or retainer types. This type of bearing cannot take end thrust, as balls tend to ride over slot edges; and this type cannot be disassembled without tending to wear the slots into the ball paths.

The constant for the carrying capacity of bearing with one race slotted is $K=5$, 2000 r. p. m. in formula $L=Knd^2$.

The constant for the carrying capacity of bearing with both races slotted is $K=2.5$, 2000 r. p. m. in formula $L=Knd^2$.

The non-slotted (uninterrupted race) types differ in design in the method of filling, and are divided into three principal types:

(a) *SKF* self-aligning bearing filled by means of retainer.

(b) Fafnir type in which races are tapered so that the balls may be entered by springing the races apart. (Sketch 11.)

(c) Hess-Bright type in which the race diameters are such that six balls can be entered by springing the races, as shown in Sketch 10.

METHODS OF BALL SPACING

There are two methods of ball spacing, the non-retainer type and the retainer type.

The non-retainer type or full ball type is a bearing in which centrifugal force is depended upon for spacing the balls. In this type the race is filled with balls, so that there is a space of about one-fourth (¼) the ball diameter between any two balls when they are forced apart. Centrifugal force tends to keep the ball spaced when the bearing is in operation at high speed; but, due to there being no retainer to cushion balls and reduced vibration, this type is noisier than the retainer type. It is generally considered that this type of bearing is undesirable for high-speed work where great accuracy is necessary, but in actual practice this type is efficient; examples, torpedo gyro, Sperry gyro-compass, Fafnir bearing. It makes a better bearing for slow speeds with great weight, for according to the formula for carrying capacity of a bearing, it will be noted that the greater the number of balls the greater the carrying capacity of the bearing.

the Southern commerce destroyers prolonged the losing struggle of the Confederacy by so much as one day, nor would the result of the war have been different had there been a hundred *Alabamas* —so long as they were used purely as commerce destroyers.

The permanent decline of American maritime commerce was due much less to commerce destroying than to legislative, economic and fiscal causes subsequent to the war.

In the Spanish-American War neither combatant had a merchant fleet worthy of the name, and so it affords no examples of war on commerce, though our men-of-war, of course, captured such Spanish merchant ships as came their way. The war was in effect concluded by the destruction of the Spanish fighting squadrons at Manila and Santiago.

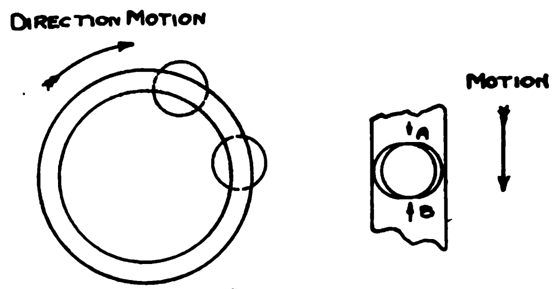
In the Russo-Japanese War the Russian division based on Vladivostok made several raids on Japanese commerce, in one case getting as far down as the entrance to Tokyo Bay, but the influence of these raids on the final result of the war was absolutely nil. The Japanese refused to draw any part of their main fleet away from their strictly military objective—the Russian fleet of fighting ships in Port Arthur.

Even in this mere outline sketch of commerce destroying in past wars, it may be seen that certain facts repeat themselves with such consistency that we can but conclude that they belong to the constant teachings in the school of history. We see that commerce destroying has ever been used by the nation having the weaker navy—weaker in fighting ships, in morale, or in the willingness to run the legitimate risks of normal war on the sea; that the main incentives to such warfare are economy and the longing for an easy way to success in war; that the surest way of accomplishing the ruin of an adversary's commerce is to destroy the fighting force that protects it, rather than to make direct war on commerce; that commerce attacked directly sometimes actually increases in war, when protected by adequate fighting ships properly used; that, at its best, commerce destroying has been able to inflict no more than a small percentage of loss on an enemy's total maritime commerce; that the monetary loss to an enemy caused by attacking her merchant ships has never amounted to more than a very small fraction of the cost of war; that an enemy country has never been brought to the verge of bankruptcy through attacking its commerce; that war on commerce has never produced

The retainer types differ in the design and construction of the ball retainers.

Construction.—The retainers may be either a built-up retainer or a solid retainer. There is not much choice between the two when comparing well-made samples of each.

The material used in manufacture of retainers *does* make a great difference in the life of the bearing. Retainers are made of the following materials: Steel, grey iron and bronze. *Steel* is good for low speeds and low heat. At high speeds, it loses its temper and breaks up, thus ruining the bearings. Not considered good for high-speed work. *Grey iron* is better than steel for high-speed work, but is not in any way as efficient as bronze for high-speed work. *Bronze* is considered the best material for



SKETCH 12.

retainers. It is less noisy than retainers of other material, has longer life and makes a successful retainer for high-speed work.

Design.—The design differs in the method of spacing the balls. To space the balls, the retainers must touch the balls at some point or points. All points on the surface of the balls traveling about the race have either motion of translation or motion of rotation, or both. The axis of the ball at right angles to the plane of the race (plane of translation) has but one motion, *i. e.*, translation. Therefore a retainer touching only at the axis of rotation of the ball will cause less friction from contact with the ball than a retainer touching at any other point.

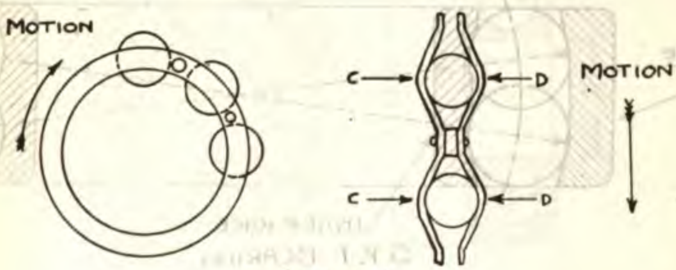
The type that spaces balls by touching at points *A* and *B*, *i. e.*, points other than axis of rotation, is objectionable, because it causes friction (heat) and tends to shorten life of bearing by wearing retainer, the particles of which, tracked into races by the balls, destroys the concentricity of the bearing.

The type that spaces balls by holding them at axis of rotation, *i. e.*, at points *C* and *D*, is, therefore, the most approved type, because there is a minimum of wear and friction.

In general, it is better, if design allows, to use the spaced ball type instead of full ball type; if necessary, increase size of balls and decrease number to within practical limits to perform duty.

The disadvantages of the full ball type are:

1. Increase of friction.
2. Increase of cost (more balls).
3. Increase of noise of operation.
4. Increase of lubrication needed, because there is nothing to retain the oil in contact with balls, as in case of retainer bearing.



Sketch 13.

METHOD OF ALIGNMENT

There are, in reference to alignment, two types of bearings, viz., the non-aligning and the self-aligning bearings.

The non-aligning bearings are the ordinary types of bearing whose races must be in the same plane to operate without binding.

The self-aligning bearings are the types of bearings which allow certain freedom of movement of the races independent of each other without binding.

There are two kinds of self-aligning bearings: (a) Cone and cup type; and (b) the *SKF* type. (See Sketch 5 for cone and cup type.)

It will be noted that outer race of *SKF* bearing is ground on a radius from the center of the bearing and the balls ride on the inner race on this radius so that the planes of the two races do not have to coincide for proper operation. Of these two types the *SKF* is the better. It does not have to be adjusted for ball

If financial loss be made sufficiently great and sufficiently widespread to bring suffering or extreme deprivation upon many individuals it may have military effect by damping the general zeal for war or even by arousing a willingness to make great concessions for peace. In the case of the financial losses here considered, we have seen that the very interests that suffer the losses are the ones that to a certain degree have these losses compensated. In this age maritime losses are very generally distributed by means of insurance, and there are no indications of real suffering brought on by maritime losses at sea.

The effect of this form of warfare on the morale of those practicing commerce destroying is, of course, speculative, but it is highly probable that a navy that systematically practices war on defenceless merchant ships almost exclusively for any length of time will deteriorate in those characteristics that distinguish virile, courageous, manly naval personnel. When the French Navy was for so long practicing direct war on English commerce, the morale of her navy was at its lowest ebb. That this was not racial is at once apparent when we recall that during this same time the morale of the French army was above reproach.

We know that heroic action develops the capacity for heroic action, and the development of military character is very largely dependent upon the nature of the service one is required to render.

Though possibly not strictly within the scope of our inquiry, it may be of interest to note that friction with neutrals is one of the historic corollaries of war on commerce. It is not difficult for one warring on the commerce of an enemy to convince himself that an occasional attack on a neutral will produce results of benefit to his country, and such attack is so *easy*, and resistance so futile. Of course, such attacks may be of use in specific instances, but the resulting resentment of the neutral, if nothing more, is bound to react to the advantage of his enemy, particularly if that neutral is of importance in the family of nations. Especially in this day the good will of neutrals is an asset of considerable importance to a belligerent, and war on commerce is a very likely way of alienating such good will.

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DETERIORATION OF STEEL PROPELLER SHAFTING

By Commander C. H. J. Keppler, U. S. Navy

A remarkable instance of pitting of steel shafting after only seven months' service was disclosed recently upon the docking of the U. S. S. *New Orleans* at Navy Yard, Boston. The *New Orleans* is one of the older types of protected cruisers, of about 3400 tons, and is sheathed with copper. About the middle of July, 1917, the installation of new propeller shafts was completed at the Navy Yard, Puget Sound, but the urgent war requirements did not permit encasing the steel shafting with the usual composition sleeve. The tail shafting, a hollow steel forging 13¾" at its greatest diameter, has a section 30' 8" long between the end of stern tube and forward edge of strut bearing, which except for the protective coats of paint was directly exposed to the sea water.

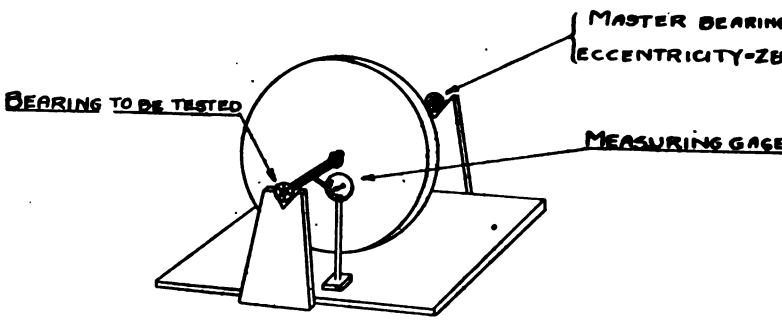
Upon examination in dock on February 16, 1918, the surface of both shafts was found to be covered with innumerable, deep, irregular pits, some areas of from 10 to 16 square inches and from ½" to ¾" deep (see Fig. 1). Near the struts and stern tubes, under the fair-waters, positions nearest the copper sheathing of the hull, were found the deepest and most numerous holes. The steel fair-waters were honeycombed with large holes and the zinc plates had entirely disappeared (see Fig. 1). A black oxidized metallic substance in the deepest pits was removed with scrapers and had the consistency and appearance of soft putty mixed with lampblack. A chemical analysis of this material gave the following:

(a) Ferrous Oxide, 35.3%.
(b) Ferric Oxide, 30.5%.
(c) Loss on Ignition, 16.0%.
(d) Undetermined, 18.2%.

Ferric Oxide is probably FeO to Fe_2O_3 after exposure to air. FeO is probably hydrated Ferrous Oxide.

during a complete revolution of the shaft is the eccentricity measured in thousandths or ten thousandths, as the case may be.

There are bearings of all degrees of tolerances on the market from poorest grade bearing, such as is used in baby carriage wheels, to the highly specialized bearing, such as is used in gyroscopic wheels. The degree of perfection is also an indication of the price, so that it behoves the designer to get the proper bearing for the work; *i. e.*, be satisfied when he gets a bearing that runs smoothly and does not wear out quickly.



SKETCH 16.

In determining the tolerances of ball bearings for a certain machine, bear in mind the following:

1. Avoid vibration, as it shortens life of bearing.
2. Vibration is caused by inaccuracies of races or balls.
3. Vibration is caused at high speed by dynamic unbalance of the load.
4. That perfect bearings will vibrate with load dynamically unbalanced.
5. With inaccurate bearings, the higher the speed the greater the vibration.
6. That the proof of the selection is a smooth running bearing.
7. The life of a bearing depends on the quality of the races, balls and retainer—a breakdown in any one of which will destroy the bearing.

KIND OF LUBRICANT

Oil is the greatest friend, and dirt the greatest enemy of the ball bearing.

The lubrication of a ball bearing is absolutely necessary. A thin film of oil has by practice given the best results. Too much oil causes friction, but the heat is carried off by the oil and immediate bad results do not arise from this source. The main objection to too much oil is that the oil becomes broken down rapidly, thus losing its lubricating qualities, which entails loss of money and labor. Too little oil results in friction and damage to bearing by over heating.

Two general kinds of lubricant are used: Grease and oil. It is necessary that either kind be chemically neutral, to prevent rusting of bearing.

Grease is used where it is necessary to close in bearing with no chance of oiling. This method is used in high-speed grinding machines of 30,000 r. p. m.

Oil is probably the best lubricant. A light grade oil, such as Arctic engine oil, has proven successful in medium and high-speed machines. It has good chemical qualities and can stand temperatures to 400° F. One thing that must always be kept in mind is that the lubricant must be kept clean, as dirt reduces life of bearing.

METHODS OF LUBRICATION

There are many methods of lubrication. With grease in use the bearing is packed in grease. With oil lubrication the lubricant is transferred to the bearing by surface attraction (wick method), by splash or by oil rings.

The wick method is the most efficient, as the oil flow can be accurately determined by the number of strands in the wick and all oil reaching the bearings is filtered. The wick should not touch the moving parts of the bearing, otherwise the filtering feature is destroyed, as lint would be carried into the bearing.

Oiling rings and splash system have two disadvantages: Firstly, they break up the oil, thus shortening its life; and secondly, they do not filter the oil and tend to flood bearings with oil sediment and chips from oil rings.

SUMMARY

In summation, the points to be borne in mind in reference to choice and use of bearings are:

1. A ball bearing has less friction than ordinary bearing.
2. Two-point contact bearing best.
3. For high speed use retainer type bearing.
4. For low speed, heavy load, use full ball type bearing.
5. Slotted type bearing objectionable where there is end thrust.
6. Double or multiple row bearings not so satisfactory as single row bearing.
7. Use bearings with 300 or 400 per cent safety factor.
8. A well-made bearing of good material will give a long life.
9. The tolerance of bearing must be determined by the amount of vibration allowable.
10. Long life for high-speed bearings depends on load and accuracy of bearing.
11. Radial bearings should not be subjected to more end thrust than 10 per cent of designed load capacity.
12. Use self-aligning bearings where perfect alignment is not essential.
13. Lubrication of ball bearings is necessary.
14. Too much oil is better than too little oil.
15. Wick oiling best.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ELECTRICAL DIVISION ABOARD SHIP

By Lieut. Commander Alex. M. Charlton, U. S. Navy

The electrical division aboard ship has grown, like Topsy, without much fathering or mothering until very recent years. It is the purpose of this article to trace the growth of the electrical personnel aboard ship from its beginning to its present organization, which is believed to be the logical and ideal one for the proper performance and upkeep of the electric plant.

Electricity for lighting purposes was first introduced on a man-of-war in 1883, when the U. S. S. *Trenton* was equipped with an Edison lighting plant. Before this time electricity supplied by batteries had been used for call bells and annunciators, and small hand-generating sets for the firing of torpedoes (mines) and guns. The power of these devices was, of course, negligible.

The dynamo of the *Trenton* was installed at the navy yard, New York, under the cognizance of the Bureau of Navigation, although the Bureau of Ordnance agreed to pay half the cost of the labor and material to fit the dynamo engine with steam and exhaust piping. The cognizance of the Bureau of Navigation over electrical apparatus was established even before electric lighting had been installed on any naval vessel.

> It (the Bureau of Navigation) shall furnish signal lights, running lights and standing lights on board vessels, including electric apparatus for lighting purposes.—General Order 293, March 30, 1882.

The rating of electrician was established in November, 1883, shortly after the *Trenton's* plant was completed, at a rate of pay of $50 per month. (General Order 310, November 17, 1883.) After being in existence two months, however, the rating was abolished (General Order 315, January 5, 1884).

As men trained for seamen gunners at this time received instructions at the torpedo station, Newport, in electrical matters, it was apparently decided that a special rating was not necessary for the upkeep of the plant on the *Trenton*. The engine and dynamo of this plant were very ruggedly built and required little attention. Reports made during the year following their installation say nothing of engine or dynamo trouble.

The office of Naval Inspector of Electric Lighting was established in January, 1887. Lieut. Commander R. B. Bradford was the first inspector. He had performed much the same duty for some time previous, and as executive officer of the *Trenton* had supervised her installation.

During this early period, while dynamos were being installed for lighting purposes by the Bureau of Navigation, the Bureau of Ordnance was also installing dynamos for use with searchlights. The searchlights were operated from series-wound machines giving about 50 volts, and the incandescent lamps from shunt-wound machines giving various voltages from 70 to 110. With the introduction of the compound-wound dynamo, both searchlights and lamps could be operated from the same machine. The divided cognizance (ordnance and navigation) brought in various types of dynamos, engines and appurtenances, and it soon became apparent that one bureau should have the cognizance of all electrical material.

This was done in 1889 when the Bureau of Equipment and Recruiting was given cognizance of all electric appliances aboard ship.

The responsibility for the care, preservation, efficiency and working of all electric apparatus on board ship rested with the navigator. He had seaman gunners and gunners' mates to stand watch on the dynamos and repair the circuits. These men were given a certain amount of instruction in electricity at Newport, but they did not specialize in that subject.

The need for specially trained men became apparent as electricity was extended to other uses besides lighting, such as signal sets, interior communication and telephone.

On account of the steadily increasing demands upon the electric plant of a ship and its consequent extension to meet the requirements, the care and attention necessary for efficiency is also growing. In view of this fact it is respectfully recommended that the rate of electrical machinist be

established with adequate pay that will compensate and attract suitable persons, and that the rating be open to any enlisted man who possesses the necessary qualifications.—Report of Naval Inspector of Electric Lighting, 1890.

This recommendation was continued without success, however, until 1898, when the ratings of chief electrician, electrician 1st class, and electrician 2d class, were established, with monthly rates of pay of $50,45 and $35, respectively.

Even in the early nineties it was believed that an officer should be in charge of the electric plant, and the midshipman aid to the navigator was sometimes given charge of the installation. As he frequently had no more than the most rudimentary knowledge of electrical principles, his supervision amounted to little. So the plant limped along under the gunner's gang, which consisted of men with little or no theoretical knowledge. With engines and dynamos which were rugged and required little upkeep, and with the only apparatus outside the dynamo room consisting of lamps and call bells, this organization was able to keep the apparatus working.

With the introduction of motors aboard ship, the situation was changed, and we find in the report of the Naval Inspector of Electrical Appliances (1898):

As the electric plant of the modern battleship has increased to such an extent that it requires the constant superintendence of an officer, I have to recommend that this duty be assigned to a junior officer who can devote his whole time and attention to the care and preservation of the plant.

And in 1899 the chief of the Bureau of Equipment (Admiral Bradford) recommended to the Secretary of the Navy:

It is respectfully urged that the time has arrived when it is necessary to detail a larger staff to take charge of electrical appliances on shipboard. At least one lieutenant and a warrant officer, in addition to a number of petty officers, should be exclusively employed for this duty as in foreign navies. At present no officer is detailed for this duty alone. The power now developed in the larger ships is . . . . almost equal to that developed by the motive steam machinery in the ships 30 years ago, when a large staff of engineer officers and others were thought necessary for its care. In addition, the appliances used in electrical installations are delicate and require a high order of intelligence and technical knowledge.

It was at this time that the *Kentucky* and *Kearsarge* were being built with 350 kilowatts generator capacity, and electrical appliances calling for 661 kilowatts. These appliances in-

cluded turret motors, ammunition hoists, boat cranes, deck winches and ventilating motors. In addition to there being this great amount of new gear, the ship had a rather complicated three-wire system for distributing current.

The Bureau of Equipment was much concerned with the constantly increasing demands for repairs and renewals to the electrical outfits of ships. Ships were not long self-sustaining electrically without extensive dockyard work. After the abandonment of the course in electricity for officers at the torpedo station, all official progress towards educating officers in electrical matters ceased. No instruction of practical value was given at the Naval Academy, and we find battleships going into commission with extensive electrical plants and no skilled personnel to care for them.

In 1899, schools of instruction were started. The course for officers was re-established at Newport, and a school for enlisted men at the navy yards in New York and Boston. The following year the school at Boston was discontinued, and a school established at Mare Island. These men were taught the rudimentary principles of electricity and had practical work with electrical machinery, in addition to work on ships under repair. Most of these men when they finished the course of instruction were eligible for rating as third-class electricians. The course for officers, held during the summer, was of an elementary character and merely touched on a variety of electrical subjects.

In 1900, it was recommended that the grade of warrant electrician be established and that warrant electricians be assigned to duty in connection with electric plants of battleships and armored cruisers.

Nothing was done toward creating a grade of warrant electricians until 1912. In that year, candidates for gunner were divided into two classes: those fitted to specialize in ordnance and those fitted to specialize in electricity. Before this time (as early as 1905) electricians had been warranted as gunners, but no effort was made to detail them for electrical duty only. There is no doubt that the warrant rank of electrician and chief electrician should be established. The present rate of electrician should then be changed to that of electrician's mate to conform to other ratings in the service.

Until very recently the electricians have not been gathered together in an electrical division. Watch bills of ships in commission during the last 20 years generally show the electricians assigned to the powder division, although sometimes they were put in the navigator's division, and sometimes split up among the various deck divisions.

As the powder division was made up of odds and ends of the complement who were put there because of their stations at general drills, no particular attention was paid to the electricians as electricians. The powder division officer had no cognizance of the electrical machinery, and his only interest in electricians consisted in mustering and inspecting them. The navigator was too busy with his other duties to pay much attention to electrical matters, and the efficiency of the plant depended on the gunners. Neither the gunner nor the electricians were skilled mechanics, and there was usually friction when it came to getting work done by the engineer's force on the dynamos and dynamo engines. So the electricians renewed gaskets, packed valves and fitted bearings as well as they could most of the time, rather than call on the engineer department. It is astonishing that the plants held together as well as they did.

The establishment of the postgraduate school at Annapolis in 1909 opened the way for the navy to obtain officers with special electrical training. Although it was stated at the time of the establishment of this school that its object was the obtaining of designing engineers and not operating engineers, yet there is no doubt in the service that the gradual outflow of electrical engineers from the postgraduate school has helped and will help the efficiency of our electrical machinery.

The navigator remained in charge of the electrical plant aboard ship until 1911, when correction No. 15 to the 1909 regulations was published. By this "the ordnance officer is the officer detailed by the department to have supervision over and be responsible for . . . . the electrical installation under the cognizance of all bureaus outside the dynamo rooms, including the wireless telegraph outfit. His responsibility as to the care, preservation and efficiency of the electrical installation begins at the dynamo-room bulkhead and embraces all electrical apparatus fittings and appliances outside the dynamo rooms." At the same time the senior engineer officer was made "responsible for the preserva-

tion and efficient working . . . . of the dynamo engines, generators and appurtenances, including all electrical apparatus and accessories contained within the dynamo rooms."

This change was brought about by continued demands of the electrical force upon the engineer department for repairs and overhaul of the dynamos.

The electricians were not competent to make proper repairs on the dynamos and each item of work had to be handled by a request of the navigator to the engineer officer.

The engineer officer did not want to transfer machinists to the navigator's division (when there was one) or to the powder division. The simplest way out seemed to be to transfer the dynamos, and their auxiliaries to the engineer department and make them part of the auxiliary division in that department.

At the same time, it seemed best to transfer the electrical machinery outside the dynamo room to the ordnance officer, as he had a particular interest in much of this machinery. The turrets were trained and guns elevated by motors, ammunition was hoisted by electricity, and the fire-control installation with its telephones, range and deflection visuals, battle order indicators, etc., began to increase in size and importance. It was felt that, with gunnery efficiency dependent absolutely on electrical efficiency, the gunnery officer would take measures to achieve the latter.

This division of cognizance aboard ship, however, did not work out in an entirely satisfactory manner. The auxiliary machinists usually had little or no knowledge of electricity and, while repairs to the steam machinery were made efficiently enough, the generators and switchboards were not sufficiently well cared for.

The duties of the ordnance officer were sufficiently arduous from a strictly gunnery point of view without putting upon him the burden of responsibility for a power plant of great diversity. He had no time for the supervision of an installation which well could take the whole time of an officer trained in electrical matters. His primary interest, naturally, was in the gunnery electrical gear, and the remainder of the plant, such as lighting-circuits, winches, cranes, steering gear, blowers, etc., was a matter of secondary importance.

The usual method of handling the situation was to turn the plant over to the electrical gunner and require him to "fix it."

On some ships there was a fire-control officer who looked out for the electrical fire-control circuits.

All of these assignments of cognizance were but evasions of the early recognized and often recommended principle that the electrical installation of a modern ship demanded the exclusive services of an experienced commissioned officer.

There was no division loyalty and *esprit de corps* among the electricians such as there is in the deck divisions. There was constant friction between the dynamo electricians and the remainder of the electrical force. There was no division officer to whom the electricians could go; no one who "spoke the same language" and would see that their interests were taken care of.

There were two paramount reasons during this time (1911-14) for not detailing officers aboard ship for electrical duty only: the first was a lack of officers specially trained in electricity, and the second was a general deficiency of commissioned personnel in the service, due to new ships going into commission and to increased demands for officers on ships already in commission.

Having in mind the above-mentioned difficulties, the commanding officer of the *Texas,* when she was first commissioned in 1914, organized the electricians as a part of the engineer department. An electrical postgraduate had inspected the electrical machinery during its installation and was detailed by the commanding officer as electrical officer when the vessel was commissioned.

In January, 1916, Mr. Frank J. Sprague, the eminent electrician, spent three weeks on the U. S. S. *New York.* In a report to the Secretary of the Navy, he made the following comment:

> The electrical equipment of a ship is now so complicated, and its operation and the handling of its guns so dependent upon electricity, that there should be on every first-class ship an officer who is a specialist in that scientific branch; one who might be designated as the chief electrical officer or electrical chief, as distinguished from the terms electrical engineer or electrician, which are oftentimes misused. At present the electrical knowledge is more or less divided between the ordnance officer, gun captains, electrical gunner and electricians of the ship; that is, between commissioned and warrant officers and enlisted men. It would be far better if a commissioned officer who has made a specialty of the subject were given a complete supervision and responsibility with regard to electrical equipment.

In a memorandum to the secretary, the Bureau of Steam Engineering made the following comment on the above statement:

The bureau heartily endorses this recommendation. At present, the senior engineer officer and the gunnery officer of a ship divide responsibility for maintenance and operation of the electric plant. Both officers have multitudinous duties, and many parts of the installation do not directly affect the efficiency of the department of either officer. The latest ships have an electrical officer whose sole duty is the care of the electric plant; but this officer is merely detailed by the captain, and by naval regulations has no standing. The position should be made official and should be made subordinate to senior engineer. This is the case on the *Texas*, whose electric plant is, so far as the bureau knows, the best handled in the fleet. The bureau in the past has received very little help from the fleet in improving electric installations, because there has been no one charged exclusively with such installations, who took the interest to make suggestions.

The subject of electrical organization aboard ship was referred to the fleet and there was no doubt expressed concerning the necessity for an electrical officer on battleships. The consensus of opinion favored the electrical officer being a subordinate of the engineer officer, and in August, 1916, the regulations were changed to incorporate the following:

Par. 2826 (R):

1. The electrical officer shall be an assistant to the senior engineer officer. He shall be charged with the maintenance, care, and preservation of all electrical appliances installed on the ship, including radio and fire-control appliances and other electrical signal apparatus; to this end the electrical gunner and all electricians attached to the ship shall be subject to his orders so far as maintenance, care and preservation of all electrical appliances are concerned.

2. He shall, through the proper channels, make recommendations to the Navy Department concerning any alterations in methods or in the apparatus or installation of new devices which will contribute to increased efficiency or economy of the electric installations.

3. He shall have the custody of the record of electrical appliances and all plans relative to the electric installation, supervise the keeping of the electric log, make the routine reports required by the Naval Instructions, make lists of repairs needed, and keep all records of electrical work done.

4. He shall be charged with conducting all tests of electric apparatus called for by the Navy Department, and with the making of reports thereon.

5. When fitting out he shall make a thorough inspection of the entire electric outfit of the ship, including spare parts and fittings, stores and supplies. He shall also carefully inspect all electrical storerooms, workshops and other space intended for electrical equipment or supplies. Should

he discover any defects or deficiencies he shall immediately make a detailed written report of the facts to the commanding officer.

The history of the electricians on board ship has been reviewed in detail to show how long it has taken to reach the logical assignment of the electrical personnel.

The organization, routine, tests, etc., developed on the *Texas* is given below. This organization has been in effect practically without change since the *Texas* was commissioned in 1914. It is very flexible, permitting the ultilization of men on work for which they are best fitted and also permitting the concentration of any needed number of men upon any emergency or repair job without going outside the division.

ELECTRICAL DIVISION, U. S. S. *TEXAS*—ORGANIZATION, ROUTINE AND TESTS

1. The electrical division of the engineer department consists of all the general electricians assigned to the ship, and a sufficient number of machinist's mates and firemen to make repairs upon and stand watch over the turbines and auxiliaries.

2. The electrical division has cognizance of and makes repairs upon all electrical machinery of the ship, including the turbo-generators, all motors, telephones, fire-control circuits, storage batteries, interior communication circuits and gyro-compasses.

3. The complement of the electrical division is as follows:

	Electrical officer.
	Electrical gunner.
3	Chief electricians.
10	Electricians, 1st class.
10	Electricians, 2d class.
10	Electricians, 3d class.
1	Chief machinist's mate.
2	Machinist's mates, 2d class.
4	Firemen, 2d class.
5	Firemen, 3d class.
7	Deck division strikers.
1	Engineering division striker, fireman, 3d class.
53	

One electrician is detailed as storeroom keeper in the supply department from the above complement.

The deck division strikers have billet numbers in the electrical division, mess with the electricians, muster with the electrical division and stand bag and hammock inspection with the electricians. They are considered to be electricians in training, and do duty as electricians with the exception of

general quarters and coaling ship, where they work with the divisions from which they were detailed.

4. The division is divided into five units, each in charge of a chief petty officer. These units are as follows:

P1 Dynamo watch.
P2 Lighting and workshop.
P3 Power and searchlights.
P4 Interior Communication and fire-control.
P5 Dynamo repair.

These units are further subdivided into four sections to conform to the section arrangement of other divisions.

5. The duties of the various units are as follows:

Dynamo Watch.—This unit stands watch on the running dynamos and the ventilating blower motors throughout the ship. A first- or second-class electrician is on watch in the running dynamo room, with a fireman, 2d class, to look out for the turbines and auxiliaries. In the idle distribution room is a second- or third-class electrician and in the running distribution room a striker who makes the rounds of the ventilating blower motors once an hour. The dynamo watch is responsible for the cleanliness of the compartments assigned to the electrical division, except the workshop, storeroom, telephone repair shop and battery locker.

COMPLEMENT

1 Chief electrician.
2 Electricians, 1st class.
4 Electricians, 2d class.
2 Electricians, 3d class.
4 Firemen, 2d class.
4 Strikers.

A watch in four is stood in the dynamo room.

Lighting and Workshop.—This unit has cognizance of all lighting and battle lighting circuits, except the magazine lights, including navigational and signal lights, and also the galley ranges and bakeshop ovens and the motors of the galleys. The lighting circuits are divided into: Gun and and half-deck forward; gun and berth deck aft; bridge and upper decks; and fire and engine rooms. An electrician is detailed for work in the workshop and to look out for the storeroom. A striker from the engineer's force is detailed to assist on the fire- and engine-room circuits. The electricians on the lighting circuits also look out for the room and desk fans.

COMPLEMENT

2 Electricians, 1st class.
4 Electricians, 2d class.
1 Striker.

The chief electrician of the dynamo watch also has charge of this unit unless there is a chief electrician on board in excess of the complement, when he is put in charge.

Power and Searchlights.—This unit has charge of all power and ventilating blower motors, searchlights, storage batteries and the electrical work in the power boats. The various motors and searchlights are divided among the electricians assigned to this unit for cleaning, testing and repair. A third-class electrician is assigned to each turret. He has charge of the motors and lighting circuits in the turret and magazines, and looks out for the 5-inch ammunition hoists assigned to him. He is required to carry out the routine of cleaning, testing, making insulation tests, etc. All repairs in the turrets are supervised by the chief electrician in charge of the unit. Each searchlight has an electrician in charge, both for cleaning and testing, and for operating during night torpedo defence quarters.

COMPLEMENT

1 Chief electrician.
3 Electricians, 1st class.
7 Electricians, 3d class.
2 Strikers.

Interior Communication and Fire-Control.—This unit has cognizance of all interior communication circuits, ship's service telephones, gyro-compasses, fire-control telephones and instruments and firing circuits up to the locks of the guns. This includes the director system for the main battery and the sight lighting for the 5-inch guns and the range-finders.

COMPLEMENT

1 Chief electrician.
3 Electricians, 1st class.
2 Electricians, 2d class.
1 Striker.

Dynamo Repair.—This unit consists of the machinist's mates and helpers, who make all repairs on the turbines and dynamo auxiliaries. The plants are run a month at a time, approximately; the two machines in one room taking the load on alternate days during the month. During the month the idle plant is given a thorough overhaul. As a rule, only such repairs as can be finished during working hours are undertaken in any one day, both plants being ready to run during the night, if necessary. The machinery of the idle plant is turned over under steam each week and all emergency devices tested.

COMPLEMENT

1 Chief machinist's mate.
2 Machinist's mates, 2d class.
2 Firemen, 3d class.

DUTIES OF THE DIVISION AT GENERAL DRILLS

General Quarters.—The dynamo watch reports to the dynamo rooms; starboard watch to the after dynamo room; and the port watch to the forward dynamo room. The lighting unit is divided between the forward and after repair parties. The power unit furnishes men for the repair parties; the turret electricians report to their turrets; one electrician goes to the steering motor room and one to the forced draft blowers. The I. C. and F. C. unit mans the I. C. room and the plotting room switchboards; one man is in the central station standing by the gyros, and one with gunnery officer. The chief electrician tends the fire-control switchboards. The dynamo repair unit is divided between the dynamo rooms. The deck strikers go to their gun stations.

Night Torpedo Defence Quarters.—The dynamo watch and the dynamo repair units go to the dynamo rooms. The lighting unit stands by the battle lanterns and battle circuits. The power unit mans the searchlights. The I. C. and F. C. unit is divided among the 5-inch guns to look out for buzzers and sight lighting. Deck strikers go to their gun stations.

War Watch.—The dynamo watch stands regular watch. Lighting unit stands by for calls. The power unit mans two searchlights. I. C. and F. C. unit stands a trouble watch on the bridge. The dynamo repair unit sleeps in the idle dynamo room.

Fire.—The idle plant is manned and gotten ready to start up if necessary. Men on watch in the distribution rooms cut out ventilating blowers supplying compartments in the vicinity of the fire. The lighting, power, I. C. and F. C. and radio units fall in at quarters. One electrician reports to the first lieutenant at the scene of the fire.

Collision.—The dynamo watch and dynamo repair third and fourth sections stand by to start the idle plant. The lighting unit falls in at quarters. The third and fourth sections of the power unit mans the boat cranes, deck winch, capstan and the dynamo trunk hatches. The I. C. and F. C. unit closes water-tight doors and then falls in at quarters. The third and fourth sections are used for above duties, as they are the last to leave the ship.

Abandon Ship.—The division abandons ship as follows:

First section	First motor sailer, first trip.
Second section	Second motor sailer, first trip.
Third section	First motor sailer, second trip.
Fourth section	Second motor sailer, second trip.

The third and fourth sections of the dynamo watch and dynamo repair units man the dynamo rooms until second party is about to leave ship. Dynamo watch remains in the dynamo rooms until the ship is abandoned, escaping up the trunks. The cranes, deck winch and capstan are manned by the third and fourth sections of the power unit until they are no longer required.

ROUTINE, INSPECTIONS, TESTS AND REPAIRS IN DIVISION

DAILY

Dynamo Station

Test insulation on lighting and searchlight circuits.
Jack over spare generator armature.
Inspect all stations.
Test auxiliary lighting circuits.
Inspect recording ammeters.
Test signals for interlocking circuit-breakers relay.
Inspect dynamo room exhaust blower motors.
Check up dynamo log sheets and get out data.
Make up work sheet and write up work book.
Inspect running generators.
Inspect all blowers hourly.
Clean switchboards.

Lighting and Shop Station

Inspect and check up daily insulation book.
Make up work sheets and write up work book.
Inspect all lighting circuits for burned out lamps, blown fuses and low insulation.
Inspect galley and bakeshop ranges, ovens and motors.
Test out all bridge lights and instruments that are on lighting circuits, and signal searchlights.

Power Station

Inspect all ventilating blowers, ice machines, machine shop motors, laundry motors, carpenter shop motors and flushing pump motors.
Clean, inspect and test searchlights.
Test all turret motors.
If under way, test steering motor and forced draft motors.

I. C. and F. C. Station

Insulation test on all circuits.
Inspect and clean gyro-compasses.
Inspect time-firing device.
Inspect ship's service telephone board.
Before battle stations or general quarters, test director firing, range and deflection instruments, turret bells and buzzers, and target turret transmitters.
Before getting under way, test all bridge instruments.
Test general alarm gongs and howlers.

Dynamo Repair Station

Inspect running plant and all sea valves.
Jack idle machinery.
Carry on repairs.

WEEKLY

Dynamo Station

Inspect all power division compartments.
Blow out generators in running plant with air.
Check up all watt meters.
Check up voltmeters on running generator panel.
Inspect circuit-breaker settings.

Lighting and Shop Station

Clean up work shop.
Inspect and test branch circuits in fire and engine rooms for low resistance.
Clean up storeroom A-24-S.
Check up lamp expenditures.
Check up G. S. K. chit book.
Inspect work books and work order briefs.
Test out fire and engine room auxiliary lights.
Inspect and check up portables.

Power Station

Inspect and test fresh-water pump motors, capstan motors, deck winch motor, forced draft motors, all turret motors and panels, steering motor, 5-inch hoist motors, ice-cream motor.
Make insulation test on all motors and turrets.

I. C. and F. C. Station

Discharge and charge gyro-batteries, I. C. batteries, telephone batteries and auxiliary lighting-circuit batteries.
Test general alarm contact makers.
Test all water-tight door warning-signal contact makers.
Clean plotting room and I. C. room, telephone repair shop.

Dynamo Repair Station

Test idle generators and auxiliaries under steam.
Test atmospheric valve, sentinel valve, back-pressure trip and overspeed trip.

MONTHLY

Dynamo Station

Insulation test of power and lighting circuits.
Insulation test of generators overall.
Inspection of circuit-breakers.
Renew oil in dynamo room exhaust blowers.
Inspect and clean thoroughly generators after monthly run.

Lighting and Shop Station

Inspect and check up tools and instruments.

Inspect and test lighting circuits and panels.

Inspect and clean out switches and panels of galley and bakeshop ranges, ovens and motors.

Inspect and test portable blowers.

Inspect stores and material in A-24-S.

Power Station

Make individual insulation test on each motor.

Water and charge all storage batteries.

Open and inspect all closed laundry motors.

I.C. and F.C. Station

Inspect and clean motor generators for telephone, telephone-ringing, I. C., gun-firing, and warning signal.

Inspect and clean all batteries.

Inspect helm-angle transmitter.

Dynamo Repair Station

Overhaul idle plant. Re-pack generator and auxiliary steam stops and generator throttles.

Examine water and oil service. Grind in and re-pack valves.

Examine, clean and adjust generator and auxiliary reducing valves.

Examine carbon packing on all turbines.

Re-pack lifting valves.

Filter oil in generator wells.

Blow out condenser, examine tubes and zincs.

Circulating engine: Take off water casing of pump, examine keys and set screws. Take off cylinder head, examine cylinder, piston and valve. Vaseline cylinder. Examine oil pump and bearings. Re-pack rod and stem.

Air pump: Take off cylinder head. Vaseline cylinder. Same for valve chest. Re-pack rods and stems. Take bull's eyes off on water end. Examine valves.

Hotwell pump: Take off cylinder head and valve-chest cover. Vaseline cylinders. Re-pack rod and stem. Examine valves in water end.

Traps: Take up on leaks. Grind in main and pilot valves. Re-pack cut-out valves.

Drain valves: Grind in and re-pack all reducing and pump drain valves, and steam and exhaust valves on all pumps.

Hotwell tank: Clean out and take up on leaks.

QUARTERLY

Dynamo Station

Make insulation tests on all circuits from dynamo and distribution rooms.
Make up log sheet data for quarterly returns.

Make insulation test on generators as follows: Armature to armature; drop across the separate fields; air-gap clearance; ground test over-all; insulation of feeders; armature fields and rheostat to ground.

Lighting and Shop Station

Check up quarterly report.
Inspect and repair all bracket fans.
Inventory tools and instruments.

Power Station

Lift portable searchlights off base and examine turntables, if these lights are kept on deck.

SEMI-ANNUALLY

Dynamo Station

Before target practice, shut power off distribution boards, tighten all studs and inspect for weak insulation and chafed leads.

Dynamo Repair Station

Grind in generator and auxiliary steam stops, sentinel, back-pressure, and carbon steam seal relief valves, atmospheric and trap cut-out valves.
Overhaul carbon steam seal reducing valves.
In dry dock: Grind in sea valves and renew zincs.
Take clearances on all generator rotors.
Examine thrusts.

ANNUALLY

Power Station

Lift mast searchlights off bases and examine turntables.

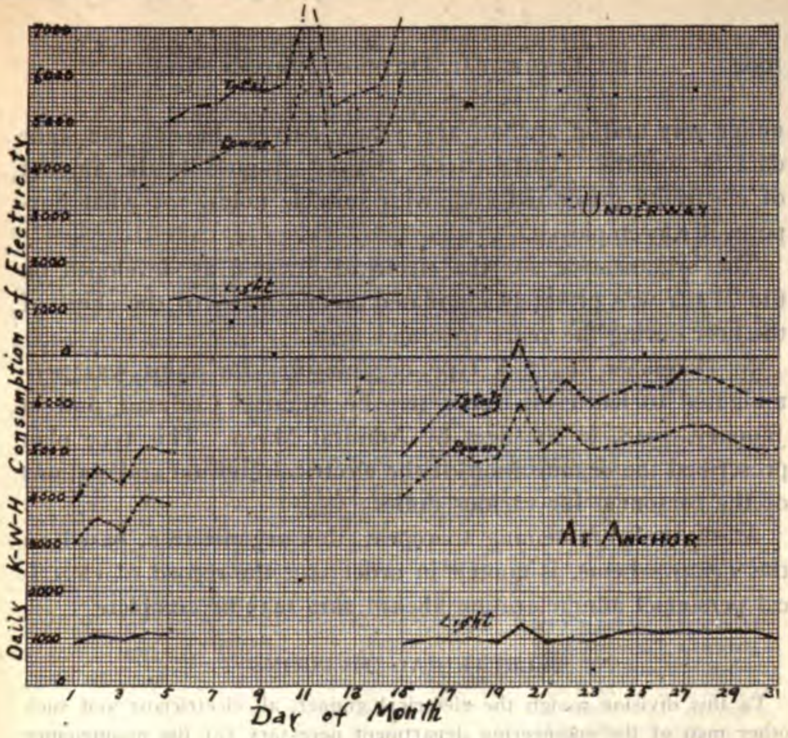
I. C. and F. C. Station

Make complete examination of all range and deflection circuits and tighten all connections.

Forms were printed aboard ship for reporting results of tests, current consumption, etc.

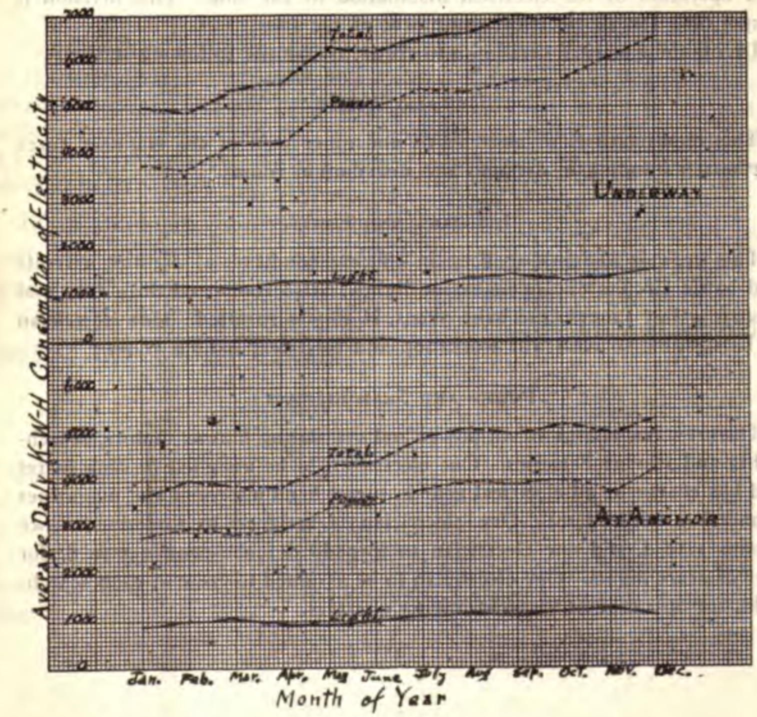
In addition to these forms, a book was kept with a list of circuit numbers on each page, against which was written each day the insulation resistance of the various circuits.

Monthly curves (Figs. 1 and 2) were also kept, showing the light, power and total consumption of electricity for each day



Daily K-W-H Consumption of Electricity
Total
Power
Light
Underway
At Anchor
Day of Month

FIG. 1.



Average Daily K-W-H Consumption of Electricity
Total
Power
Light
Underway
At Anchor
Jan. Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec.
Month of Year

FIG. 2.

under way and at anchor, and yearly curves showing the same data by months. These curves showed graphically the amount of electricity generated and, with suitable notes, for what purposes it was employed.

The organization for the electrical division as developed on the *Texas* was privately circulated among many of the ships of the fleet during the years 1916 and 1917.

In December, 1917, a type organization for ships was promulgated to battleship force two by Admiral Coffman, and in January, 1918, to the fleet by Admiral Mayo. This type plan prescribed the organization of the electrical division and stations of the personnel for various duties.

At the risk of seeming to repeat, this organization, based on the *Texas* scheme, is quoted in order that the record of electrical personnel administration aboard ship may be complete.

ELECTRICAL DIVISION

To this division assign the electrical gunner, all electricians and such other men of the engineering department necessary for the maintenance and operation of the electrical installation of the ship. This division is responsible for all electrical equipment of the ship.

Divide the electrical division into crews to man the following stations:

DYNAMO WATCH

This crew consists of electricians and other men of the engineer force for watch standing in dynamo and distribution rooms.

LIGHTING AND POWER

This crew is assigned to keep in efficient condition all lighting circuits and battle circuits except magazine lights. Also room and desk fans and electric galley ranges, and bake ovens, if ship is so fitted. One electrician to be detailed to electrical workshop and electrical issuing room.

POWER AND SEARCHLIGHTS

The crew has charge of all power and ventilating blower motors, searchlights and storage batteries. One electrician to be assigned to each turret and has charge of all electrical gear in turret handling room and magazines connecting with turret. One electrician is assigned to torpedo defence groups 1 to 4, and one electrician to torpedo defence groups 5 to 8, for care of searchlights. One electrician to be assigned to crew of each searchlight, for operation at torpedo defence quarters.

INTERIOR COMMUNICATION AND FIRE CONTROL

This crew has the duty of testing and electrical repair of all interior communication circuits and instruments, ship's service telephones, gyro-compasses, fire-control telephones, and instruments and firing circuits up to the locks of the guns, and the range-finders.

Divide each station into four sections, for the purpose of standing watch, liberty, messing, berthing, etc.; as far as practicable, assign men to stations so that they will have the same station for battle that they have for maintenance.

Other extracts from the "type organization" applying to the electrical personnel are set forth below:

MANNING OF OFFICERS' STATIONS

Order in which stations are to be manned	Stations		Rank, station, watch, division, etc.
	Battle	Other than battle	
37	Electrical officer. Plotting room	Electrical officer. Assistant engineering officer.	Lieutenant, Lieutenant (j. g.) or ensign, selected for his knowledge of electricity, has charge of electrical division. May stand watch in engineering department.

The electrical officer, if qualified for fire-control duties, shall be in charge of the plotting room. If the electrical officer is not so qualified, the above arrangement shall be used. If there is no regular electrical officer assigned, a plotting room officer performs the necessary electrical duties; the general doctrine being that the electrical officer shall have some station in the plotting room.

In this organization the maintenance of the dynamo engines and their auxiliaries are not under the electrical officer, but are under the auxiliaries division of the engineering department.

Stations of electrical personnel for ship-control, fire-control and general drills are given below:

SHIP CONTROL

CENTRAL STATION

One electrician for gyro-compasses.

INTERIOR COMMUNICATION ROOM

One electrician tends switchboard, looks out for motor generators and stands by to shift navigational instrument control from one station to another as required.

DIVISIONAL DUTIES

Stops blowers	Electrical division, only in part of the ship where fire is located. Stands by to start if needed. Stops all magazine supply blowers.
Electrical repairs	Electrical. To pull fuses; in case of electrical fires supply portable lights and blowers.

COLLISION BILL

COLLISION OTHER THAN IN ACTION

Electrical gunner	Starts generators for power for cranes, winches and anchor gear winches.

The above organization is in effect to-day for battleships of the Atlantic fleet.

Soon after the outbreak of war, 100 men with electrical training were obtained and given commissions as lieutenants, junior grade. After a course at the Naval Academy, they were sent to sea for three months, most of them to battleships, two to a ship. At the end of that time, one was retained aboard for electrical duty, and the other made available for shore duty at navy yards and in the Bureau of Steam Engineering.

The experience of these officers in civilian life, together with their naval training, makes them a valuable asset, and it is hoped that those who have proved their value and aptitude for the service may be retained in the navy.

The electrical plants of our battleships are in efficient condition to-day, and every effort must be made to keep them so. Their increased efficiency is due in a large measure, it is believed, to the assignment of electrical officers to our ships and the placing of all electrical personnel and material under their supervision.

he discover any defects or deficiencies he shall immediately make a detailed written report of the facts to the commanding officer.

The history of the electricians on board ship has been reviewed in detail to show how long it has taken to reach the logical assignment of the electrical personnel.

The organization, routine, tests, etc., developed on the *Texas* is given below. This organization has been in effect practically without change since the *Texas* was commissioned in 1914. It is very flexible, permitting the ultilization of men on work for which they are best fitted and also permitting the concentration of any needed number of men upon any emergency or repair job without going outside the division.

ELECTRICAL DIVISION, U. S. S. *TEXAS*—ORGANIZATION, ROUTINE AND TESTS

1. The electrical division of the engineer department consists of all the general electricians assigned to the ship, and a sufficient number of machinist's mates and firemen to make repairs upon and stand watch over the turbines and auxiliaries.

2. The electrical division has cognizance of and makes repairs upon all electrical machinery of the ship, including the turbo-generators, all motors, telephones, fire-control circuits, storage batteries, interior communication circuits and gyro-compasses.

3. The complement of the electrical division is as follows:

	Electrical officer.
	Electrical gunner.
3	Chief electricians.
10	Electricians, 1st class.
10	Electricians, 2d class.
10	Electricians, 3d class.
1	Chief machinist's mate.
2	Machinist's mates, 2d class.
4	Firemen, 2d class.
5	Firemen, 3d class.
7	Deck division strikers.
1	Engineering division striker, fireman, 3d class.
53	

One electrician is detailed as storeroom keeper in the supply department from the above complement.

The deck division strikers have billet numbers in the electrical division, mess with the electricians, muster with the electrical division and stand bag and hammock inspection with the electricians. They are considered to be electricians in training, and do duty as electricians with the exception of

general quarters and coaling ship, where they work with the divisions from which they were detailed.

4. The division is divided into five units, each in charge of a chief petty officer. These units are as follows:

P1 Dynamo watch.
P2 Lighting and workshop.
P3 Power and searchlights.
P4 Interior Communication and fire-control.
P5 Dynamo repair.

These units are further subdivided into four sections to conform to the section arrangement of other divisions.

5. The duties of the various units are as follows:

Dynamo Watch.—This unit stands watch on the running dynamos and the ventilating blower motors throughout the ship. A first- or second-class electrician is on watch in the running dynamo room, with a fireman, 2d class, to look out for the turbines and auxiliaries. In the idle distribution room is a second- or third-class electrician and in the running distribution room a striker who makes the rounds of the ventilating blower motors once an hour. The dynamo watch is responsible for the cleanliness of the compartments assigned to the electrical division, except the workshop, storeroom, telephone repair shop and battery locker.

COMPLEMENT

1 Chief electrician.
2 Electricians, 1st class.
4 Electricians, 2d class.
2 Electricians, 3d class.
4 Firemen, 2d class.
4 Strikers.

A watch in four is stood in the dynamo room.

Lighting and Workshop.—This unit has cognizance of all lighting and battle lighting circuits, except the magazine lights, including navigational and signal lights, and also the galley ranges and bakeshop ovens and the motors of the galleys. The lighting circuits are divided into: Gun and and half-deck forward; gun and berth deck aft; bridge and upper decks; and fire and engine rooms. An electrician is detailed for work in the workshop and to look out for the storeroom. A striker from the engineer's force is detailed to assist on the fire- and engine-room circuits. The electricians on the lighting circuits also look out for the room and desk fans.

COMPLEMENT

2 Electricians, 1st class.
4 Electricians, 2d class.
1 Striker.

The chief electrician of the dynamo watch also has charge of this unit unless there is a chief electrician on board in excess of the complement, when he is put in charge.

Power and Searchlights.—This unit has charge of all power and ventilating blower motors, searchlights, storage batteries and the electrical work in the power boats. The various motors and searchlights are divided among the electricians assigned to this unit for cleaning, testing and repair. A third-class electrician is assigned to each turret. He has charge of the motors and lighting circuits in the turret and magazines, and looks out for the 5-inch ammunition hoists assigned to him. He is required to carry out the routine of cleaning, testing, making insulation tests, etc. All repairs in the turrets are supervised by the chief electrician in charge of the unit. Each searchlight has an electrician in charge, both for cleaning and testing, and for operating during night torpedo defence quarters.

COMPLEMENT

1 Chief electrician.
3 Electricians, 1st class.
7 Electricians, 3d class.
2 Strikers.

Interior Communication and Fire-Control.—This unit has cognizance of all interior communication circuits, ship's service telephones, gyro-compasses, fire-control telephones and instruments and firing circuits up to the locks of the guns. This includes the director system for the main battery and the sight lighting for the 5-inch guns and the range-finders.

COMPLEMENT

1 Chief electrician.
3 Electricians, 1st class.
2 Electricians, 2d class.
1 Striker.

Dynamo Repair.—This unit consists of the machinist's mates and helpers, who make all repairs on the turbines and dynamo auxiliaries. The plants are run a month at a time, approximately; the two machines in one room taking the load on alternate days during the month. During the month the idle plant is given a thorough overhaul. As a rule, only such repairs as can be finished during working hours are undertaken in any one day, both plants being ready to run during the night, if necessary. The machinery of the idle plant is turned over under steam each week and all emergency devices tested.

COMPLEMENT

1 Chief machinist's mate.
2 Machinist's mates, 2d class.
2 Firemen, 3d class.

DUTIES OF THE DIVISION AT GENERAL DRILLS

General Quarters.—The dynamo watch reports to the dynamo rooms; starboard watch to the after dynamo room; and the port watch to the forward dynamo room. The lighting unit is divided between the forward and after repair parties. The power unit furnishes men for the repair parties; the turret electricians report to their turrets; one electrician goes to the steering motor room and one to the forced draft blowers. The I. C. and F. C. unit mans the I. C. room and the plotting room switchboards; one man is in the central station standing by the gyros, and one with gunnery officer. The chief electrician tends the fire-control switchboards. The dynamo repair unit is divided between the dynamo rooms. The deck strikers go to their gun stations.

Night Torpedo Defence Quarters.—The dynamo watch and the dynamo repair units go to the dynamo rooms. The lighting unit stands by the battle lanterns and battle circuits. The power unit mans the searchlights. The I. C. and F. C. unit is divided among the 5-inch guns to look out for buzzers and sight lighting. Deck strikers go to their gun stations.

War Watch.—The dynamo watch stands regular watch. Lighting unit stands by for calls. The power unit mans two searchlights. I. C. and F. C. unit stands a trouble watch on the bridge. The dynamo repair unit sleeps in the idle dynamo room.

Fire.—The idle plant is manned and gotten ready to start up if necessary. Men on watch in the distribution rooms cut out ventilating blowers supplying compartments in the vicinity of the fire. The lighting, power, I. C. and F. C. and radio units fall in at quarters. One electrician reports to the first lieutenant at the scene of the fire.

Collision.—The dynamo watch and dynamo repair third and fourth sections stand by to start the idle plant. The lighting unit falls in at quarters. The third and fourth sections of the power unit mans the boat cranes, deck winch, capstan and the dynamo trunk hatches. The I. C. and F. C. unit closes water-tight doors and then falls in at quarters. The third and fourth sections are used for above duties, as they are the last to leave the ship.

Abandon Ship.—The division abandons ship as follows:

First section	First motor sailer, first trip.
Second section	Second motor sailer, first trip.
Third section	First motor sailer, second trip.
Fourth section	Second motor sailer, second trip.

The third and fourth sections of the dynamo watch and dynamo repair units man the dynamo rooms until second party is about to leave ship. Dynamo watch remains in the dynamo rooms until the ship is abandoned, escaping up the trunks. The cranes, deck winch and capstan are manned by the third and fourth sections of the power unit until they are no longer required.

ROUTINE, INSPECTIONS, TESTS AND REPAIRS IN DIVISION

DAILY

Dynamo Station

Test insulation on lighting and searchlight circuits
Jack over spare generator armature
Inspect all stations.
Test auxiliary lighting circuits
Inspect recording ammeters
Test signals for interlocking [illegible]
Inspect dynamo [illegible]
Check [illegible]
Make [illegible]
Inspect running generators
Inspect all [illegible]
Test switchboards.

[illegible]

WEEKLY

Dynamo Station

Inspect all power division compartments.
Blow out generators in running plant with air.
Check up all watt meters.
Check up voltmeters on running generator panel.
Inspect circuit-breaker settings.

Lighting and Shop Station

Clean up work shop.
Inspect and test branch circuits in fire and engine rooms for low resistance.
Clean up storeroom A-24-S.
Check up lamp expenditures.
Check up G. S. K. chit book.
Inspect work books and work order briefs.
Test out fire and engine room auxiliary lights.
Inspect and check up portables.

Power Station

Inspect and test fresh-water pump motors, capstan motors, deck winch motor, forced draft motors, all turret motors and panels, steering motor, 5-inch hoist motors, ice-cream motor.
Make insulation test on all motors and turrets.

I. C. and F. C. Station

Discharge and charge gyro-batteries, I. C. batteries, telephone batteries and auxiliary lighting-circuit batteries.
Test general alarm contact makers.
Test all water-tight door warning-signal contact makers.
Clean plotting room and I. C. room, telephone repair shop.

Dynamo Repair Station

Test idle generators and auxiliaries under steam.
Test atmospheric valve, sentinel valve, back-pressure trip and overspeed trip.

MONTHLY

Dynamo Station

Insulation test of power and lighting circuits.
Insulation test of generators overall.
Inspection of circuit-breakers.
Renew oil in dynamo room exhaust blowers.
Inspect and clean thoroughly generators after monthly run.

Lighting and Shop Station

Inspect and check up tools and instruments.

Inspect and test lighting circuits and panels.

Inspect and clean out switches and panels of galley and bakeshop ranges, ovens and motors.

Inspect and test portable blowers.

Inspect stores and material in A-24-S.

Power Station

Make individual insulation test on each motor.

Water and charge all storage batteries.

Open and inspect all closed laundry motors.

I. C. and F. C. Station

Inspect and clean motor generators for telephone, telephone-ringing, I. C., gun-firing, and warning signal.

Inspect and clean all batteries.

Inspect helm-angle transmitter.

Dynamo Repair Station

Overhaul idle plant. Re-pack generator and auxiliary steam stops and generator throttles.

Examine water and oil service. Grind in and re-pack valves.

Examine, clean and adjust generator and auxiliary reducing valves.

Examine carbon packing on all turbines.

Re-pack lifting valves.

Filter oil in generator wells.

Blow out condenser, examine tubes and zincs.

Circulating engine: Take off water casing of pump, examine keys and set screws. Take off cylinder head, examine cylinder, piston and valve. Vaseline cylinder. Examine oil pump and bearings. Re-pack rod and stem.

Air pump: Take off cylinder head. Vaseline cylinder. Same for valve chest. Re-pack rods and stems. Take bull's eyes off on water end. Examine valves.

Hotwell pump: Take off cylinder head and valve-chest cover. Vaseline cylinders. Re-pack rod and stem. Examine valves in water end.

Traps: Take up on leaks. Grind in main and pilot valves. Re-pack cut-out valves.

Drain valves: Grind in and re-pack all reducing and pump drain valves, and steam and exhaust valves on all pumps.

Hotwell tank: Clean out and take up on leaks.

To Find A's Speed.—Clamp the compass rose *a* on the right side of the board with the zero mark of *b* on any vertical line and with *C's* course at *i*. Plot positions *A* and *B* on the proper bearings and distances as shown in sketch, using compass roses *a* and *b* and arm 0°. Connect *AB*. Clamp the arm *f* of the protractor on *C's* course as shown and lay the edge on or parallel to the line passing through *B* with 14-knot graduation at *B*. Place the pointer of arm *g* on course 218°. *A's* speed can then be read off the arm *g* where it intersects *AB*.

To Find the Distance.—In this case the line *xy* runs off the board before intersecting the horizontal line passing through *B*. Draw another line *uv* through *B*, parallel to *xy*, so that *uv* and *xv* will intersect the same horizontal line. Part of the distance run can be measured from *A* to *y* and the remainder from *u* to *B*.

The time is found as explained in Example 1.

EXAMPLE 2 (CASE 2)

C is standing on course 180° magnetic, speed 10 knots, signals *A*, who is bearing 340° magnetic, distant 1200 yards, to take position on bearing 40° magnetic from *C*, distant 1000 yards. *A's* speed is 22 knots.

In this case *A* is on *C's* starboard quarter and must take position on the port quarter. For this reason the compass rose is clamped on *C's* course at *k* and the arm *f* of the protractor is on or parallel to the nearest vertical line passing through *B*. The course, distance and time are found in the same manner as described in other problems.

EXAMPLE 2 (CASE 3)

C, standing on course 48° magnetic, speed 11 knots, signals *A*, who is 60° on her starboard bow, distant 950 yards, to take position 1000 yards ahead of *C*. *A's* speed, is 18 knots. Find distance, course and time.

In this case *A* is on *C's* starboard bow, making it necessary to work down the board. The compass rose is clamped on *C's* course at *l*. The course is found the same as in the other problems. In this case *xy* runs off the bottom of the board before intersecting the *vertical* line passing through *B*. Draw another line, *uv*, parallel to *xy* so that it intersects the vertical line pass-

INTERIOR COMMUNICATION AND FIRE CONTROL

This crew has the duty of testing and electrical repair of all interior communication circuits and instruments, ship's service telephones, gyro-compasses, fire-control telephones, and instruments and firing circuits up to the locks of the guns, and the range-finders.

Divide each station into four sections, for the purpose of standing watch, liberty, messing, berthing, etc.; as far as practicable, assign men to stations so that they will have the same station for battle that they have for maintenance.

Other extracts from the "type organization" applying to the electrical personnel are set forth below:

MANNING OF OFFICERS' STATIONS

Order in which stations are to be manned	Stations		Rank, station, watch, division, etc.
	Battle	Other than battle	
37	Electrical officer. Plotting room	Electrical officer. Assistant engineering officer.	Lieutenant, Lieutenant (j. g.) or ensign, selected for his knowledge of electricity, has charge of electrical division. May stand watch in engineering department.

The electrical officer, if qualified for fire-control duties, shall be in charge of the plotting room. If the electrical officer is not so qualified, the above arrangement shall be used. If there is no regular electrical officer assigned, a plotting room officer performs the necessary electrical duties; the general doctrine being that the electrical officer shall have some station in the plotting room.

In this organization the maintenance of the dynamo engines and their auxiliaries are not under the electrical officer, but are under the auxiliaries division of the engineering department.

Stations of electrical personnel for ship-control, fire-control and general drills are given below:

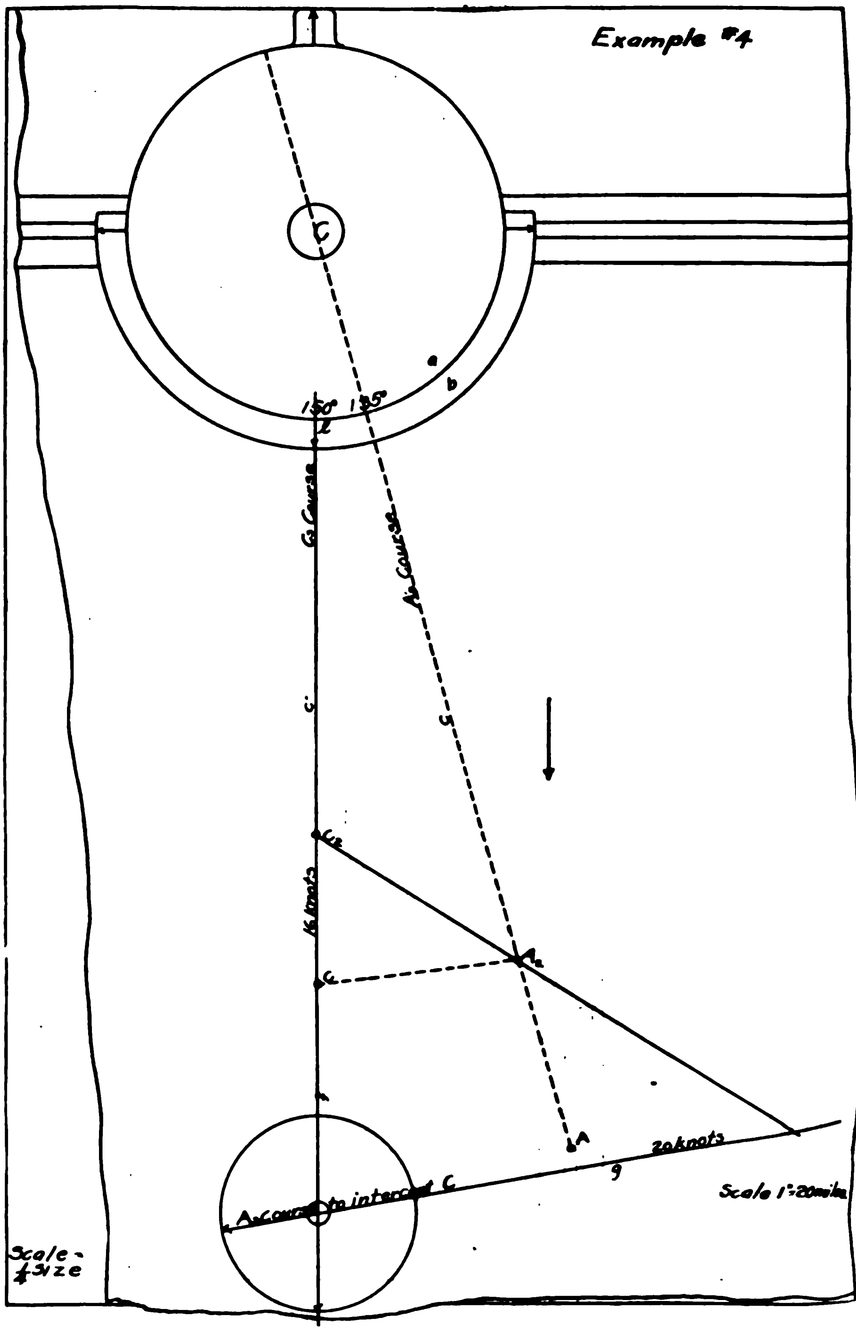
SHIP CONTROL

CENTRAL STATION

One electrician for gyro-compasses.

INTERIOR COMMUNICATION ROOM

One electrician tends switchboard, looks out for motor generators and stands by to shift navigational instrument control from one station to another as required.


Example #4
C
a
b
150° 135°
G Course
A₁ Course
c
5
C₂
16 knots
A₂
C₁
A
20 knots
9
A₂ Course to intercept C
Scale 1" = 20 miles
Scale - ¼ size

EXAMPLE 5

To determine how to allow for turning when taking station on another moving ship.

A destroyer *A* is scouting ahead of the flagship *C* and is ordered to take position on *C's* starboard bow, distant 800 yards. *C* is heading 250°, speed 10 knots. *A's* speed is 18 knots, tactical diameter 800 yards, advance 800 yards, transfer 400 yards. Speed reduced in turning 20 per cent. What should be the bearing and distance of *C* when *A's* helm is put over?

Solution.—Set compass rose on *C's* course at *i*. Locate *A* on *C's* starboard bow, distance 800 yards. On the vertical line passing through *A* locate *A2* 800 yards (tactical diameter) from *A*. *A* has to run 1457 yards at 14.4 knots, performing the evolution in 3 minutes. During this time *C* runs 1000 yards. On the horizontal line passing through *A2* locate *A3*, 1200 yards from *A2*.

The bearing and distance of *C* from *A3* can be read off the compass rose *a* and arm *c*, respectively.

The distance that *A* runs during the evolution is equal to $\frac{pi}{2}$ times the tactical diam.—plus the advance minus the transfer.

$$1457 = \frac{pi \times 800}{2} + (600 - 400) \text{ yards.}$$

The distance *A2A3* is equal to the distance *C* runs in the time it takes *A* to perform the evolution plus the difference between the advance and transfer. $(1200 = 1000 + (600 - 400).)$

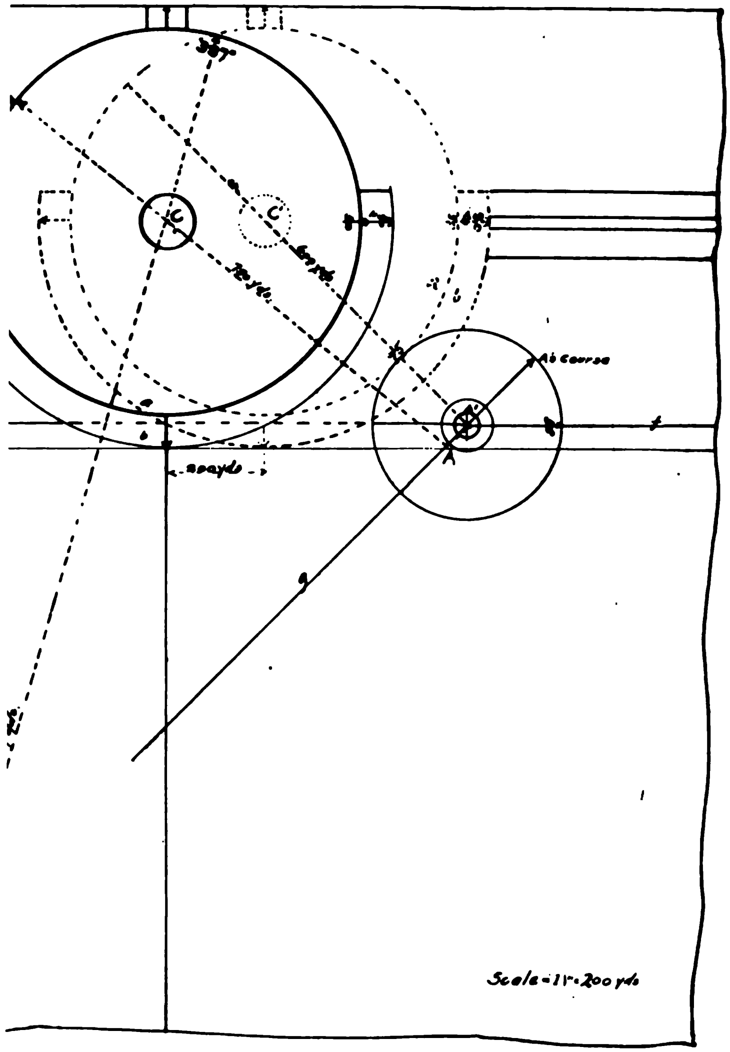
EXAMPLE 6

Anchoring on a given bearing and distance from another ship's anchor.

A vessel *A*, approaching an anchorage on course 5° magnetic, is ordered to anchor on bearing 95° magnetic from *C's* anchor, distant 600 yards. *C* signals bearing of her anchor 50° magnetic, distant 200 yards from foremast. The distance of observer's position from hawse-pipe on *A* is 30 yards. Find the bearing and distance of *C's* foremast when *A's* anchor should be let go.

Clamp the compass rose *a* on 50° at *i*. With the arm *c* and the compass rose *a* locate the position of *A's* anchor at *A1*. Move the compass rose 200 yards to the left and clamp in position.

Set the arm *f* of the protractor on 50° and lay the edge parallel to the horizontal line passing through *A1*. Set the pointer of


C
C'
A
A's Course
200 yds
Scale = 1" = 200 yds

ated in yards to the same scale as the arm *c*, and are also graduated in knots. In this case, one-half inch equals 1 knot, although any arbitrary scale may be used provided both arms are graduated the same. A pair of cross wires locates the center of the compass rose.

The plotting sheet, mounted on the board, is of cross-section paper, four squares to the inch. In this case one side of a square equals 25 yards or 50 yards, depending on the scale used. Every fourth line is drawn in red ink to facilitate plotting.

The diagram near the lower right-hand corner will be found useful in determining the time required to perform the evolution and will be explained in connection with examples of problems given below.

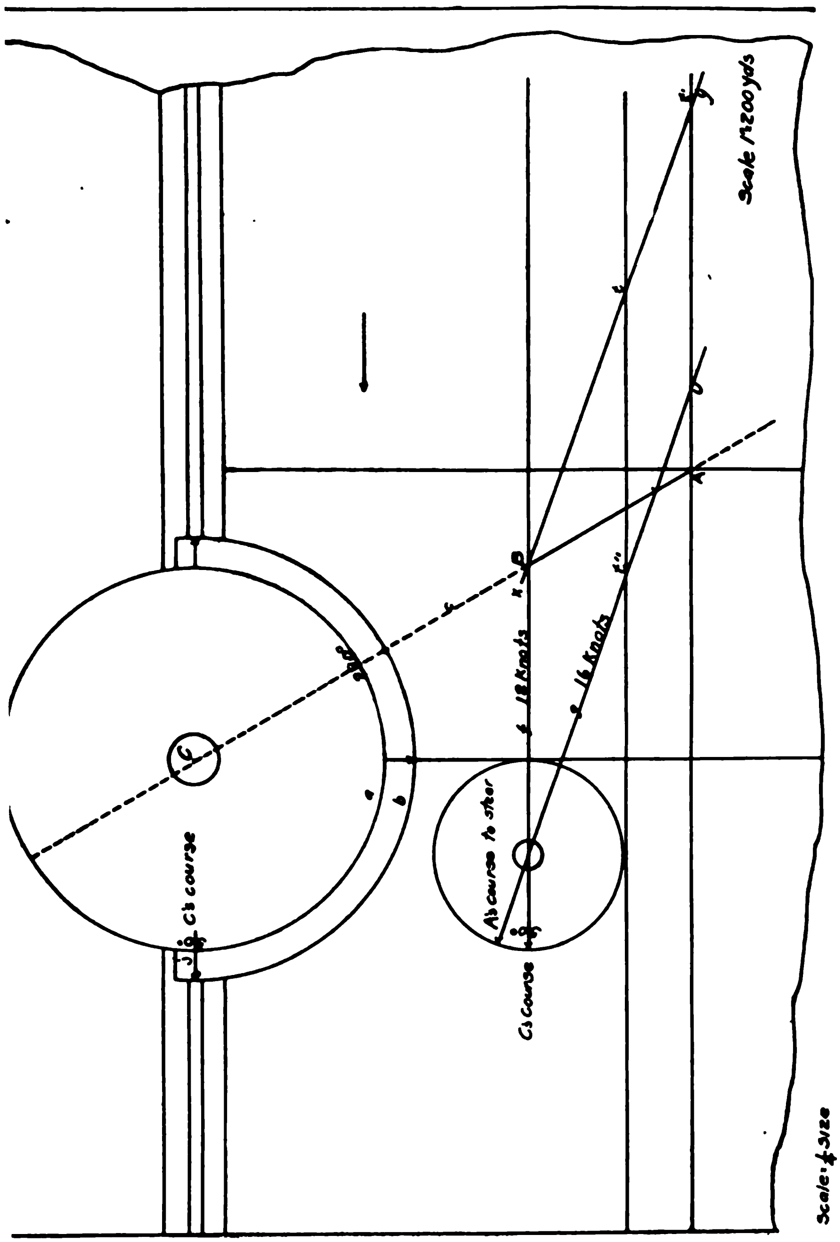
In the sketches of problems, the cross-section is not drawn. The black horizontal and vertical lines shown are those nearest the plotted positions on the plotting sheet. The full lines in red ink are the only lines required to be drawn in working out the problems. In some cases it is not necessary to draw any lines, as shown in Examples 3 and 5. In Example 5 the turning circle need not be plotted.

In some cases where it is desired to moor on a given bearing from another ship's anchor, the compass rose *a* cannot be used. In such cases, however, all the plotting can be done at any convenient position on the board, using the protractor. One arm can be clamped on north and laid parallel to the vertical lines, or on east, laying the edge parallel to the horizontal lines. By using the protractor the various bearings and distances entering into the problem can be laid off much more quickly than with dividers and parallel rulers as in the case when using the regulation mooring board.

EXAMPLE 1

Forming on a moving ship, preserving the bearing. Speeds unequal.

C, standing on course 50° magnetic, speed 12 knots, signals *A*, who is bearing 290° magnetic, distant 1200 yards, to close in to 800 yards and maintain bearing. *A's* available speed is 16 knots. Find *A's* course, distance and time required to perform the evolution.


Scale 1"=200 yds
18 Knots
16 Knots
A's course to steer
C's course
C's course
Scale: ¼ size

arm *g* on A's course and draw *A1A2*. The bearing and distance of *C's* foremast when *A's* anchor is let go can be read off the compass rose and arm, respectively.

C's bearing and distance can be checked frequently along the line *A2A1* as at *A2*.

The red line *A1 A2* is the only line necessary to be drawn in working the problem.

EXAMPLE 7

Mooring on a given bearing from a ship already moored.

A vessel *C*, moored with anchors on line of bearing 25° to 205° magnetic, signals *A*, who is bearing 65° magnetic, distant 2425 yards to moor with 45 fathoms of chain on each anchor on bearing 60° magnetic from *C*, distance 800 yards. Line of bearing of *A's* anchors 25° to 205°. *C's* heading is 325 magnetic. The distance of *C's* foremast from a point midway between her anchors is 75 yards. The position of observer on *A* is 50 yards abaft the hawse-pipe. *A's* advance is 400 yards.

Find the bearing and distance of *C's* foremast when each of *A's* anchors should be let go.

Find the bearing and distance of *C's* foremast when *A's* helm should be put over in making the turn to come on line of bearing of anchorage.

Solution.—Clamp the compass *a* on *C's* heading 325° at *i*. Set the arm *c* on line of bearing of *C's* anchors 25° to 205° and draw *xy*. Plot the point *l* on bearing 60° from *C*, distance 800 yards. *A* is the point where *A's* stem will be when moored. Transfer *xy* parallel to itself through *A*. *x'y'* is the line of be aring of *A's* anchors and also the course on which *A* must approach the anchorage. Lay off *t* and *t'* 45 fathoms on each side of *A*. *t* and *t'* are the positions of *A's* anchors. Lay off *u* and *u'* 50 yards from *t* and *t'*, respectively. *u* and *u'* are the positions of observer on *A* when anchors are let go. Move the compass rose *a* 75 yards to the left, keeping *C's* heading at *i*. The center of the compass rose is the position of *C's* foremast. The bearing and distance of *C's* foremast from *u* and *u'* can be read off the compass rose and arm, respectively.

Plot *A's* position at *A1*, using compass rose and arm. Draw *vw* at right angles to *x'y'*, passing the line through *A1*. Lay off 400 yards, *A's* advance, to *e*. The bearing and distance of *C's* foremast when helm should be put over can be read off the compass rose and arm as before.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Change in Board of Control

Captain A. St. Clair Smith, U. S. Navy, tendered his resignation as a member of the Board of Control upon being detached from duty in the United States and his resignation was accepted by the Board with regret on May 13, 1919. Captains T. L. Johnson and E. J. King, U. S. Navy, were elected members of the Board of Control to fill the vacancies created by the resignations of Colonel Dion Williams, U. S. M. C., and Capt. A. St. Clair Smith, U. S. Navy.

Membership.

Life, regular and associate membership, 5779.
New members: 20. Resignations: 17.
Deaths:

Rear Admiral Charles H. Manning, U. S. N. Ret.
Ensign J. D. Edwards, U. S. N.

Dues

The annual dues ($2.50) for the year 1919 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS *are to be sent, and thus insure their receipt.*

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 10th of each month.

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ANNAPOLIS, MD., MAY 15, 1919.

INFORMATION INDEX PAGE

PROFESSIONAL NOTES

PREPARED BY

COMMANDER S. A. TAFFINDER, U. S. Navy

GENERAL ARRANGEMENT

GERMANY

GERMAN MINE-LAYING CRUISERS.—Among the German warships now in custody at Scapa Flow there are two which invite special attention, representing as they do the sole example of originality in naval design that modern German construction has offered. The vessels in question are the *Bremse* and *Brummer,* officially rated as light cruisers, but possessing certain features that put them in a class by themselves. They are, in fact, high-speed mine-layers, and in the opinion of officers who have surveyed them they are uncommonly useful ships for this work. The *Bremse* (*Anglicè* Gadfly) was launched from the Vulkan yard, Stettin, at midsummer, 1916, and completed before the end of that year. The *Brummer* (Growler) was built by the Schichau yard, at Danzig, and completed in December, 1916. Full details of the ships have still to be published, but their dimensions, etc., are approximately the following: Length on waterline, 435 feet; beam, 43½ feet; mean draft, 16½ feet; displacement, 4150 tons. Machinery: Turbines of Parsons type, driving four screws; 14 Schulz-Thornycroft boilers for mixed firing. Maximum fuel supply, including oil, 850 tons. Designed horse-power 32,000 for a speed of 29.5 knots—on trial a mean of 30.2 knots is said to have been maintained for three hours. It appears, however, that on this occasion the ships were in a light condition, and on service their best reliable speed is said not to exceed 29 knots, though they can make 30 for short spurts. The scantlings are flimsy, judged by ordinary standards, and the limited coal supply presupposes a design framed with a special regard to operations in the Narrow Seas. This is borne out by the fact that the living quarters are very cramped, and the general arrangements for accommodating the crew of 370 are somewhat primitive. The same scrupulous regard for economy in

weight is revealed by an inspection of these vessels above water. In general they differ in appearance from other German light cruisers by having pronounced "clipper" stems, cased in funnels, and the minimum of superstructure. On the forecastle there is a 45-caliber 5.9-inch gun, with shield; a second gun of this size is placed between the first and second funnels on the boat deck; a third on the deckhouse abaft the main mast, with a blast screen projecting well over the quarter deck, where the fourth 5.9-inch gun is situated. This disposition of armament gives a broadside of four 5.9-inch guns, fire ahead being limited to one gun, and two guns training astern. On the boat deck between the third funnel and the mainmast are two 3.4-inch guns on high angle mounts. Above the conning-tower is a fire-control station with a rangefinder. The bridge carries a closed-in chart house constructed of splinter-proof steel, and above is a platform for two large searchlights. Each of the three funnels appears to have a steel glacis at the base as protection against splinters. The after bridge is open, with a single searchlight position above it.

The *Bremse* is reported to have carried 300 mines, but it is not easy to discover where such a large number could have been housed. Two pairs of rails are laid along the quarter deck for transporting the mines to the stern. It is stated, however, that special arrangements exist for releasing mines below water, the object being to deceive hostile scouts or aircraft with regard to the nature of the work on which the vessel was employed when under observation.

At the time of their completion the *Bremse* and *Brummer* were probably the fastest cruisers afloat. In addition to laying mines, they seem to have been used occasionally for raiding convoys in the North Sea, and information from enemy sources credits these two vessels with the principal rôle in the action of October 17, 1917, off the Norwegian coast, when the British destroyers *Strongbow* and *Mary Rose* were lost, together with a number of merchantmen in their convoy. News of the convoy's position and course having been received by wireless from a scouting Zeppelin, the *Bremse* and *Brummer*, with several destroyers, at once left the Baltic and succeeded in intercepting their prey. Steaming at high speed, and using their 5.9-inch guns, the cruisers were able to make short work of the two destroyers and the unarmed merchantmen, after which they withdrew before pursuit could become effective.

It is rather doubtful whether further ships of this type exist. Two other units are said to have been built, viz., *Hummel* (Bumble-bee) and *Wespe* (Wasp), but the report cannot be confirmed. The only ships previously built in Germany for the special duty of mine-laying were the *Nautilus* and *Albatross*, launched in 1906 and 1907 respectively. They displace 1950 to 2200 tons, and can steam at 20 knots. Another of the few existing vessels of this type is the Swedish mine-layer *Claes Fleming*, completed in 1915. She is of 1748 tons, and has a speed slightly above 20 knots. In our own navy it has not been deemed necessary to design ships specially for mine-laying, which during the war was carried out by vessels of almost every description, from battleships to submarines. Several flotilla leaders and a number of the larger destroyers were temporarily fitted up as mine-layers. The *Abdiel*, a flotilla leader launched at Birkenhead in 1915, was attached to the Grand Fleet as a "flying mine-layer," and in this capacity made things very unpleasant for the retreating German fleet after the Battle of Jutland. At the other end of the scale is the battle-cruiser *Courageous*, which is equipped with gear for sowing mines. Of the six old cruisers of the *Apollo* class, that were reconstructed as mine-layers before the war, several were scuttled as block ships on the Belgian coast, and the remaining vessels are now out of service.—*The Engineer*, 4/18.

A dispatch from Berlin states that Baron Gemingen, nephew and successor of Count Zeppelin, intends to attempt to cross the Atlantic in the Zeppelin dirigible known as the *Z-72*. The armistice conditions prevent the completion of the airship, on which about two weeks' work is required.

The cruiser is 715 feet long with a diameter of more than 60 feet. She will have seven motors of 240 horse-power each. Her gas capacity will approximate 2,000,000 cubic feet. Baron Gemingen estimates that the distance from Friedrichshaven to Washington can be covered in 68 hours, depending upon the weather. It is asserted in Zeppelin circles that under favorable conditions the new airship could make the round trip without landing.—*Aerial Age Weekly*, 5/5.

GREAT BRITAIN

H. M. BATTLE CRUISERS "REPULSE" AND "RENOWN."—In the early months of the war the need for additional battle cruisers of very high speed and armed with big guns, became more and more apparent, both to deal with raids on our coasts by enemy battle cruisers and with possible raids further afield. The value of this type of ship was also most clearly demonstrated at the Battle of the Falkland Isles. The British Admiralty therefore decided on the advice of Lord Fisher in January, 1915, to lay down a new type of cruiser, of great length and limited draft, and of very much increased speed, to meet this need. The battle cruisers *Repulse* and *Renown* were therefore ordered, the former from Messrs. John Brown and Co., Ltd., Clydebank, and the latter from the Fairfield Shipbuilding and Engineering Company, Ltd., Glasgow, at the beginning of January, 1915. Both ships are alike in every respect, and were the largest and most noteworthy warships added to the British fleet during the war. The vessel was successfully launched on January 8, 1916.

The *Repulse* left Clydebank Yard, a commissioned ship, on August 14, 1916, or in 19½ months from the date when the requisite information was received by Messrs. John Brown and Co., and the Fairfield Company to proceed with the detailed drawings in conjunction with the Admiralty officials, and to send out orders for material.

On a preliminary run to Ailsa Craig immediately after the vessel reached the Tail-of-the-Bank, the machinery was gradually worked up to 107,000 s. h. p., and on the following day, during the four hours' trial, the mean horse-power developed for the first two hours was 117,000 and for the subsequent two hours 121,000. Further trials were carried out in the Firth of Clyde when the vessel was loaded to about 30,000 tons' displacement, and over a measured course a speed of nearly 32 knots was attained, the machinery developing over 119,000 s. h. p.

The *Repulse* was the largest and most powerful warship in the world at the time, her length being 790 feet, breadth 90 feet, and depth to upper deck 41 feet, with a normal displacement of about 27,000 tons. The great length in proportion to depth gives the appearance of a large type of light cruiser rather than a battle cruiser, but on closer examination, the two barbettes, each having a pair of 15-inch guns highly mounted for ahead attack, equal in power to those fitted in the super-dreadnoughts, and a similar pair of 15-inch guns mounted in a turret aft, give a strong impression of the great size of the vessel. These guns are each arranged to train through 150 degrees on either side of the middle line, and give a concentrated broadside fire, equal to 75 per cent of that of the latest battleships, thus making the vessel very powerful in attack.

The secondary armament consists of seventeen 4-inch B. L. guns, 15 of these being arranged on triple mountings, two sets on the conning-tower platform level on each side of the forward funnel, and three sets on the

middle line on the flying and the shelter deck level. The single 4-inch B. L. guns are placed on the shelter deck, on each side abreast of the conning-tower, with a training sweep of 155 degrees. Two 3-inch high-angle guns are mounted on pedestals on the shelter deck abreast after the funnel, four 3-pdr. Q. F. guns on the same deck abreast the forward funnel, and five machine guns. In conjunction with these guns, there are fitted on platforms attached to the funnels six 36-inch single searchlight projectors, two similar projectors on the compass platform, and two 24-inch single signalling searchlights at the after end of the conning-tower platform. The vessel is fitted with two 21-inch under-water broadside torpedo tubes, placed in a compartment between the platform and the lower deck forward of the forward magazine; stowage is provided for ten torpedoes.

The conning-tower is of oval form, having armour 10 inches thick, with an inner gun control tower with revolving hood and armored rangefinder. An armored torpedo control tower, with revolving hood and rangefinder for controlling the fire of the torpedoes, is placed on the after flying deck. In addition to these towers, which are situated in commanding positions, there are fitted on the foremast high above the navigating platforms a spotting top, a 15-inch gun director platform, and a 4-inch gun director platform; also a director platform and rangefinder for anti-aircraft guns on the main mast; and a signal distributing station in the armored house on the shelter deck under the main conning-tower. The intelligence and de-coding offices are in similarly protected houses placed on the forecastle and shelter decks respectively.

The vessel is minutely sub-divided, having six boiler rooms, four engine rooms, and a cellular double bottom, extending from the middle line around the side and under the main or protective deck. A longitudinal bulkhead forming the boundary of the oil tanks extends alongside the engine rooms, boiler rooms and magazines, with an inner bulkhead forming an air space for the extent of the boiler rooms.

The armor consists of a main belt about 9 feet 6 inches wide extending from abreast the after barbette to forward, and aft of these positions for a further length of 84 feet forward, and 62 feet aft of reduced thickness. The armor belt is finished off by a transverse armor bulkhead forward and aft, and two additional transverse armor bulkheads are fitted to resist end on fire. The maximum thickness of the armor of the barbettes is 7 inches. The forward conning-tower armor is 10 inches thick, and the torpedo control tower 3 inches thick. The main or protective deck is 2 inches thick on the slopes with an additional strake of 2 inches high-tension protective plating in the vicinity of the water-line. The lower deck aft is 3½ inches thick over steering gear.

Structurally, the vessel is very substantially built, the shell plating of the topsides and the forecastle deck consisting of two thicknesses of high tensile steel of a total thickness of 1½ inches, and the bottom plating is generally 1 inch thick, tapered at the ends.

The chart house, admiral's and captain's sea cabins, navigating officer's cabin, are situated on the platform and shelter deck forward. The *Repulse* was completed as a flagship, the admiral's cabins being in the deck house on the after end of the forecastle deck. The ward room, captain's cabins, and principal officers' accommodation, offices, etc., are on the upper deck aft. The gun room and junior officers' cabins are placed on the main deck aft of midships. The mess decks for the crew are on the upper deck amidships and forward, and on the main deck amidships; the sick bay and operating rooms, and lavatories in connection therewith, are on the upper deck forward; the wash places for crew are on the main deck abreast the boiler rooms and forward.

The equipment of the vessel is very complete; the electric generating machinery consists of two sets of steam-driven reciprocating engines, each of 200 kw.; one turbo and one Diesel engine-driven generators of equal power placed in separate compartments forward and aft; electric boat winches, ammunition and deck winches; warping capstan; auxiliary steering gear; ventilating fans for machinery spaces and for working compartments and living quarters; electric heating for cabins, magazine cooling and icemaking plant; electric pumps for fresh water and bilge purposes; three sets of wireless installation; eight lifts for engine and boiler rooms; electric power for driving workshop machinery; a very complete installation of telephones and alarm bells; also the electrical equipment in connection with fire control, transmission of range and training of guns, danger signals, torpedo control and firing gear, and gyrocompasses. The capstan engines and cable holders are of the usual steam-driven type for the forward cable gear. The steam steering engines, controlled by telemotors, are placed on the after bulkhead in the engine room, and are connected up by shafting and gearing to a powerful set of screw steering gear operating a single balanced rudder.

The propelling machinery consists of Brown-Curtis turbines driving four shafts, two on each side of the ship. They are the largest direct-drive turbines built in the world.

The turbines are placed in two engine rooms side by side, divided by a middle-line bulkhead. In each engine room are three turbines driving the two shafts, the high pressure ahead and low pressure ahead being on the inner shaft and rigidly connected with each other, and the intermediate pressure ahead on the wing shaft. Incorporated in the same casing as the intermediate pressure ahead turbine is a high pressure astern turbine and with the low pressure ahead turbine is a low pressure astern turbine. In this view there is seen alongside the low pressure turbine for a geared set of about three-fourths of the power and the effect on size of increasing the number of revolutions where gearing is fitted between the turbine and propeller will be appreciated.

The high pressure ahead turbine consists of two wheels, each carrying three rows of blades, the pitch circle diameter of these blades being 10 feet 6 inches. The intermediate pressure ahead turbine consists of two stages of two rows of blades each, and a short drum of 12 rows of blades; then a second portion of two stages of two rows each; and a drum of 31 rows. The pitch circle diameter of these varies from 9 feet 3 inches to 10 feet. The low pressure ahead rotor consists of a drum portion of 34 rows, with a pitch circle diameter of 12 feet. The last blades are 26 inches in length and 1⅜ inches wide.

The astern turbines consist of two stages of four rows each and a drum of six rows forming the high pressure astern turbine and a wheel of three rows and a drum of nine rows forming the low pressure astern turbine. The pitch circle diameter of the high pressure astern turbine is 10 feet and of the low pressure astern 11 feet.

The propeller thrust in each case is nearly balanced by the steam thrust arranged in the turbine, so that no main thrust block is necessary, but only a comparatively small block on each line of shafting. Each of these blocks has a thrust surface of 4370 square inches on 16 collars. In order to obtain this balance in the intermediate pressure turbine, one of Mr. Curtis' latest patents was introduced, namely, to take the steam a short distance along the turbine, passing it in the forward direction, and then, by external passages, to cause it to re-enter the turbine and to travel aft for the remainder of the length of the rotor.

The intermediate shafting is 18½ inches diameter with an 11-inch hole, and the propeller shafts are 24 inches diameter with a 19-inch hole,

these being cased with gunmetal liners in the stern tubes and main brackets.

The condensers, two for each set of engines, are placed in two compartments, immediately aft of the main engine rooms, with the eduction pipes passing through the transverse bulkhead. The surface of each condenser is 19,225 square feet, or a total of 76,900 square feet for all the condensers. In the condenser room are the main circulating pumps, two per set of main engines, the evaporators and distillers, etc. The main air pumps are in the main engine room, so as to be under the control of the engineer of the watch. The forced lubrication pumps for the turbine bearings are also in the engine rooms, together with the necessary oil coolers, filters, etc., while the smaller forced lubrication pumps, coolers, etc., for the shaft bearings are in the condenser rooms.

Steam is supplied by 42 boilers of the Babcock and Wilcox type, these being entirely oil fuel fired and working at a pressure of 250 pounds per square inch. The total combustion chamber space of the boilers is 23,310 cubic feet, and the total heating surface of all the boilers is 157,206 square feet. The boilers are all alike, each of 22 sections wide, 8 feet 1 inch between headers. The bottom tubes are $3\frac{15}{16}$ inches external diameter each and the remainder of the tubes $1\frac{13}{16}$ inches external diameter. The vessel has two funnels, the forward one serving 22 boilers and the after one 20 boilers. The forward funnel is 25 feet by 16 feet 6 inches and the after one is 13 feet by 16 feet 6 inches.—*Engineering*, 4/11.

H. M. SEAPLANE-CARRYING SHIP "ARGUS."—One of the most interesting ships added to the navy during the war was the seaplane-carrying ship *Argus*, built by Messrs. William Beardmore and Co., Limited, at their works at Dalmuir on the Clyde. It is true that the Admiralty adapted the battle cruiser *Furious* to accommodate seaplanes and to permit them to rise from the deck, and this vessel, with her 90,000-h. p. geared turbine machinery, had a speed of 32 knots, which gave her a great advantage over the *Argus* in point of speed. Further, there is now being built specially for the same duty the cruiser *Eagle*, also of high speed and specially adapted to enable seaplanes to rise from her deck. The *Argus*, however, has the advantages that there is absolutely no obstruction on the flying deck, not even funnels, and that she has under this deck space for the accommodation and repair of seaplanes. She is therefore a floating hangar, the space given up for this purpose being 330 feet long, 68 feet wide over all, and 48 feet clear, with a clear height of about 20 feet. Hoists are provided from this hangar to the flying deck, and cranes are available for lifting the seaplanes from the water on to the hangar deck. The structural arrangements in the ship to meet these abnormal conditions involved problems of design and construction which were admirably worked out and proved thoroughly successful. Perhaps, however, the most novel feature is the arrangement of the uptakes from the funnels, so that the boiler furnace gases could be discharged over the stern. Here also gratifying success has been achieved, and the results reflect credit not only on the technical officers of the Admiralty, but on those responsible for the building of the ship and her machinery at Messrs. Beardmore's works.

In the early stages of the design of the superstructural work the method of supporting the flying deck was carefully considered. A ¼-inch scale model of the ship according to the proposed method of construction was sent to the National Physical Laboratory at Teddington to be tested in the air tunnel there. Exhaustive experiments on this model were carried out for the purpose of discovering the eddy-making effect of the structural work below and above the flying deck, and also about the after end,

through which air eddies the aircraft had to pass when alighting on the deck. The result of these experiments showed that to ensure the minimum of air disturbance it was necessary that the space between the hangar roof and flying deck should be as open as possible. On account of this it was decided to make the hangar roof strong enough to withstand the greatest hogging and sagging stresses likely to come on the structure and to support the flying deck by very light lattice work. In addition, expansion joints were introduced at various points to ensure that no stresses were to be taken up by the flying deck. Further, it was discovered that the emission of the hot gases through vertical funnels above the flying deck produced such serious air disturbance that the safe landing on the deck would be extremely difficult. This necessitated the fitting of the horizontal smoke ducts below the flying deck which carry the gases right aft away from the stern.

The hangar, designed to fulfill the latest requirements of the Air Board for this type of ship, is 330 feet long by 68 feet wide over all, and 48 feet clear width, and is of a capacity regarded as sufficient to accommodate 20 seaplanes.

The flying deck is 68 feet wide, is fitted all fore and aft at a distance of 14 feet 6 inches above the hangar roof, and is clear of all obstructions. The navigating bridge, bridge houses, wireless offices, etc., are placed forward under the flying deck. The chart house is capable of being raised above the flying deck level or lowered to a stowing position under the flying deck by hydraulic power, and when in raised position commands a clear all-round view.

There are two electrically-controlled lifts for raising the aeroplanes from the hangar to the flying deck. The after lift is 60 feet long by 18 feet wide, and the forward lift 30 feet long by 36 feet wide, and each is capable of lifting the largest Service planes with the wings folded back. These planes on reaching the flying deck have their wings extended and are then ready for flight. The total deck opening in way of the forward hatch is 56 feet. When the lift is at the flying deck level two roller platforms, each 10 feet wide, slide to the sides and thus completely cover the well openings. When the lift is below the flying deck these platforms are brought into the center and give a 20-foot starting platform for the run off. It was intended that aeroplanes should alight on the after part of the flying deck, and to facilitate this at night, special illuminating arrangements are provided for the guidance of pilots. In addition to the lamps at each side and across the flying deck aft to guide planes landing on the deck at night, steam jets are fitted forward at each side and at the stem for guidance in maneuvering for aircraft during daylight. On the flying deck aft a special arrangement is fitted in the form of wire mattresses, for retarding aircraft when landing. Planes that have landed in the water are specially picked up by means of two derricks with electric winches placed amidships on the flying deck, and two electric cranes abaft the hangar on the hangar deck. In addition to the stowage arranged for aircraft in the hangar, provision is made for carrying aircraft on the flying deck. When aircraft are thus stowed on the flying deck, a timber palisading can be raised around this deck to act as a wind screen. The palisades are arranged in such a manner that they can be raised simultaneously 14 feet above the deck level, and are lowered simultaneously to the flush of the flying deck. All erections on the flying deck, such as navigating and chart house jack and ensign staffs, poles for navigating and signalling lights, are arranged so that all can be lowered flush with the flying deck.

Two signal and wireless telegraphy masts are arranged so that they can be lowered flush with the flying deck having special contrivances and

winches for overhauling all slack rigging; this also applies to rangefinder and gun control instruments for use with anti-aircraft guns. Outside and around the flying deck is fitted a wide safety net.

The armament of the vessel consists of four 4-inch guns of special type for anti-aircraft and anti-submarine protection, and two 4-inch Q. F. guns. These are placed in suitable positions forward, amidships, and aft so as to afford all-round and overhead protection.—*London Engineering*, 3/28.

BATTLESHIPS AND BATTLE CRUISERS

(*Dreadnoughts and later ships only*)

NUMBER OF GUNS OF MAIN ARMAMENT ON BRITISH *v.* GERMAN

	August 4, 1914		Added during the war, less losses			
			Up to May 31, 1916		Up to November 11, 1918	
	British	German	British	German	British	German
15 in.	....	....	64	8	100	16
14 in.	....	....	10	..	10	..
13.5 in.	124	....	28	..	20	..
12 in. / 11 in.	148	184	14	48	minus 12	56
Total	272	184	116	56	118	72
Weight of broadside	279,100 lb.	116,600 lb.	190,340 lb.	52,840 lb.	226,600 lb.	77,500 lb.

We also had 12-inch, 14-inch, and 15-inch guns on monitors, but these are not taken into account in the above table, nor are guns on pre-dreadnoughts counted.

The above table shows that at the beginning of the war we had in our capital ships, dreadnoughts and battle cruisers 272 (German 184), big guns with a total broadside of 279,100 pounds (German 116,600 pounds), and by the end of the war we had added one hundred 15-inch guns, besides 13.5-inch, etc., and a net addition of 226,600 pounds broadside against sixteen 15-inch and fifty-six 12-inch with a broadside of 77,500 pounds to the German Navy.

We began with an advantage of 140 per cent weight of broadside.

At Jutland we had an advantage of 175 * per cent weight of broadside.

At finish we had an advantage of 160 per cent weight of broadside.

WAR DEVELOPMENT OF BRITISH TORPEDO-BOAT DESTROYER.—During the period of active hostilities—August 4, 1914, to November 11, 1918—25 flotilla leaders and 280 torpedo-boat destroyers were completed and delivered to the government by 16 British shipyards. Of this total of 305 vessels, eight Clyde firms contributed no less than 156.

* If two ships of *Royal Sovereign* type only just commissioned are not counted, above percentage becomes 160.

The above figures only include the British and the German Fleets; no account is taken of any of the Allied Fleets or of the Enemy Allied Fleets.—*From "Naval Construction during War," by Sir Eustace Tennyson D'Eyncourt, K. C. B., read before Institution of Naval Architects April 9, 1919.*

The progress made in the adoption of geared turbines for all classes of torpedo-boat destroyers is shown by the following figures, which give the number of vessels fitted with geared turbines delivered from August 4, 1914, to end of each year: To end of 1914, 2 destroyers; to end of 1915, none; to end of 1916, 15 destroyers; to end of 1917, 2 leaders, 59 destroyers; to November 11, 1918, 6 leaders, 62 destroyers; giving totals of 8 leaders and 148 destroyers respectively.

The *Shakespeare* was, like the *Spencer* and *Wallace*, the largest unit built by Messrs. Thornycroft for the Admiralty, and the geared turbines were designed to meet the guaranteed speed of 35 knots. The particulars of the vessels are as follows: Length on water-level, 325 feet 9 inches; beam, 31 feet 9 inches; depth, 19 feet 9 inches; armament, five 4.7 guns, one 3-inch H. A. gun, six 21-inch torpedo tubes and two depth-charge throwers. The oil fuel capacity is 500 tons, and the complement 157 men. The displacement with all oil on board is just under 2000 tons. The speed of the *Shakespeare* on official trial, which was run in the Channel, was tested by four runs over a 20 fathoms course, the ship being in fully-equipped condition with all armament and ammunition, but with 3 hours' oil fuel only on board, representing her condition in the middle of a 6 hours' full-power trial. The speed obtained in this depth of water was 38.95 knots.—*Engineering*, 3/21.

BULGE PROTECTION BRITISH SHIPS.—Immediately after the outbreak of war, Sir Eustace d'Eyncourt put forward proposals for what is now termed "bulge" protection for ships. Experiments were made, and his ideas proved to be correct, and bulges were fitted to some of the old cruisers of the *Endymion* class, and to the new large monitors mounting heavy guns. This protection consisted of a water-tight outer compartment full of air and an inner compartment open to the sea, and therefore full of water. It was a long time before any vessel fitted with this arrangement was actually torpedoed, but in the end several vessels with bulges were torpedoed, and survived.—*London Engineering*, 4/18.

BRITISH NAVAL RESERVOIR.—The large reservoir constructed at Rosyth for the storage of oil fuel for the British Navy has now been completed, and the two sections in which it is built have a combined capacity of sixty million gallons, the area occupied by the reservoir and surrounding roadway, pipe track, etc., is 11¼ acres, and the roof area is 7½ acres. The reservoir is built of concrete on a rock foundation, the site being the sandstone quarry known as Howe Cove. The final testing was carried out by pumping salt water into the reservoir from the Firth of Forth at the rate of 4000 gallons per minute.—*London Army and Navy Gazette*, 4/5.

CHANGES IN BRITISH SHIPS AFTER JUTLAND.—After the Battle of Jutland a considerable amount of additional protection was added over the magazines in practically all our ships as a precautionary measure. Only in one case was any portion of a shell found to have penetrated below the protective deck, but with the ever-increasing range at which actions have been fought, and the increasing penetration of improved shell, the danger of the decks being inadequate had to be considered. In certain ships, the under-water protection was reinforced by adding outside bulge protection.—*London Army and Navy Gazette*, 4/12.

British Naval Construction During the War

TABLE I

	Battleships						Battle cruisers		Large light cruisers	
	Iron Duke	Queen Elizabeth	Royal Sovereign	Agincourt	Erin	Canada	Tiger	Renown	Courageous	Furious
Length between perpendiculars	580ft.	600ft.	580ft.	632ft.	525ft.	625ft.	660ft.	750ft.	735ft.	750ft.
Length overall	622ft. 9in.	643ft. 9in.	624ft. 3in.	671ft. 6in.	559ft. 6in.	661ft.	704ft.	794ft.	786ft. 3in.	786ft. 6in.
Breadth, extreme	90ft.	90ft. 6in.	88ft. 6in.	89ft.	91ft. 7in.	92ft.	90ft. 6in.	90ft.	81ft.	88ft.
Load draft, mean	28ft.	28ft. 9in.	28ft. 6in.	27ft.	28ft. 6in.	28ft. 6in.	28ft. 6in.	25ft. 6in.	22ft. 3in.	21ft. 6in.
Displacement in tons	25,000	27,500	25,750	27,500	23,000	28,000	28,500	26,500	18,600	19,100
Shaft horsepower of engines	29,000	75,000	40,000	34,000	26,500	37,000	108,000	112,000	90,000	90,000
Speed at load draft, knots	21	25	23	22	21	22¾	30	32(nearly)	32	31½
Fuel at load draft, tons	900	650	900	1500	900	1150	900	1000	750	750
Coal capacity, tons	3250	....	....	3200	2120	3300	3320	....	....	....
Oil fuel capacity, tons	1050	3400	3400	620	710	520	3480	4250	3250	3400
Armament	10 13.5in. 12 6in. 4 21in. T.T.	8 15in. 12 6in. 4 21in. T.T.	8 15in. 14 6in. 4 21in. T.T.	14 12in. 20 6in. 2 21in. T.T.	10 13.5in 16 6in. 4 21in. T.T.	10 14in. 14 6in. 4 21in. T.T.	8 13.5in. 12 6in. 4 21in. T.T.	6 15in. 17 4in. 2 21in. T.T.	4 15in. 18 4in. 14 21in. T.T.	.... 10 5.5in. 18 21in. T.T.
Armour—										
Side, amidships	12in., 9in., 8in.	13in., 6in.	13in., 6in.	9in., 6in.	12in., 9in., 8in.	9in., 7in., 4½in.	9in., 6in., 5in.	6in., 1½in.	3in.	3in.
Side, forward and aft	6in., 4in.	6in., 4in.	6in., 4in.	6in., 4in.	6in., 4in.	6in., 4in.	4in.	4in., 3in.	2in. forward	2in. forward
Bulkheads, forward and aft	8in., 6in., 4in.	6in., 4in.	6in., 4in.	6in., 3in.	8in., 5in., 4in.	4½in., 4in.	4in., 2in.	4in., 3in.	3in., 2in.	3in., 2in.
Barbettes	10in. to 3in.	10in. to 4in.	10in. to 4in.	9in. to 3in.	10in. to 3in.	10in. to 4in.	9in. to 3in.	7in. to 4in.	7in. to 3in.	7in. to 3in.
Gun-houses	11in.	11in.	11in.	12in., 8in.	11in.	10in.	9in.	11in. to 7in.	9in., 7in.	7in.
Conning-tower	11in.	11in.	11in., 6in.	12in.	12in.	11in.	10in.	10in.	10in.	10in.
Protection—										
Vertical plating	1½in., 1in.	2in., 1in.	1½in., 1in.	1½in., 1in.	1½in.	2in., 1½in.	2½in., 1½in. 1in.	1½in.	1½in., 1in.	1in.
Forecastle deck	1in. amidships	1in.	1in.	1½in. amidships	1½in. amidships	1in. amidships	1½in., 1in.	1½in., 1½in.	1in.	1in.
Upper	2in. to 1½in.	2in. to 1½in.	1½in. to 1½in.	1½in.	1½in.	1½in.	1½in., 1in.	¾in.	1in.	1in.
Main	1½in. at ends	1½in. at ends	2in., 1½in., 1in.	1½in., 1in. at ends	1½in.	1½in. aft	1in. at ends	3in. to 1in.	1¾in., ¾in.	1¾in., ¾in.
Middle	2½in., 1in.	1in. amidships	2in. slope main to middle	1½in., 1in.	3in., 1in.	1in.	....	....	....	....
Lower	2½in., 1in.	3in., 1in.	1in., 2½in., 3in., 4in.	2½in., 1in.	....	4in., 2in.	3in., 1in.	2½in.	3in., 1in.	3in., 1in.

TABLE I.—Continued

	Light cruisers				Monitors						
	Arethusa	Callipode	"D" class	Raleigh	Humber	14in. gun class	12in. gun class	Marshal Soult	Erebus	9.2in. gun class	6in. gun class
Length between perpendiculars	410ft.	420ft.	445ft.	565ft.	261ft. 6in.	320ft.	320ft.	340ft.	380ft.	170ft.	170ft.
Length overall	436ft.	446ft.	471ft.	605ft.	266ft. 9in.	334ft. 6in.	335ft. 6in.	355ft. 8in.	405ft.	177ft.	177ft.
Breadth, extreme	39ft.	41ft. 6in.	46ft.	65ft.	49ft.	90ft.	87ft.	90ft. 3in.	88ft.	31ft.	31ft.
Load draft, mean	13ft. 6in.	13ft. 6in.	14ft. 3in.	17ft. 3in.	4ft. 9in.	10ft.	10ft.	10ft. 3in.	11ft.	6ft.	4ft.
Displacement in tons	3500	3750	4650	9750	1260	6150	5900	6670	8000	540	355
Shaft horsepower of engines	40,000	40,000	40,000	60,000	1450	2000	2300 to 2500	1500	6000	480 to 800	400
Speed at load draft, knots	29	29	29	30	12	6 to 7	6 to 7	6 to 7	12	12 to 13	10
Fuel at load draft, tons	260	300	300	1000	50	200	200	100	220	....	....
Coal capacity, tons	....	....	....	800	187	400	350	....	....	....	....
Oil fuel capacity, tons	810	920	1050	1600	90	....	....	235	750	30	45
Armament	2 6in. 7 4in. (1 H.A.) 8 21in. T.T.	2 6in. 8 4in. 4 21in. T.T.	6 6in. 2 3in. H.A. 12 21in. T.T.	7 7.5in. 12 3in. (4 H.A.) 6 21in. T.T.	3 6in. 2 4.7in. howitzers	2 14in. 1 6in.	2 12in. 1 to 4 6in.	2 15in. 8 4in.	2 15in. 8 4in.	1 9.2in. 1 3in.	2 6in. 1 6-pdr. ....
Armour—											
Side, amidships	3in.	3in.	3in.	3in., 2in.	....	....	....	....	....	....	....
Side, forward and aft	2in., 1½in.	2in., 1½in.	2in., 1¾in.	2½in., 1½in.	....	....	....	....	....	....	....
Bulkheads, forward and aft	....	....	1½in. 1in. aft	1in. aft	....	4in.	6in.	4in.	4in.	....	....
Barbettes	....	....	....	....	....	8in. to 2in.	8in. to 2in.	8in.	8in.	....	....
Gun-houses	....	....	....	....	....	10in., 7in., 4in.	10½in., 5½in., 4in., 2in.	13in., 11in. 4¼in.	13in., 11in. 4¼in.	....	....
Conning-tower	6in.	6in.	....	3in.	....	6in.	6in.	6in.	6in.	....	....
Protection—											
Vertical plating	....	....	....	....	....	1½in.	1in.	1in.	1in.	....	....
Forecastle deck	....	....	....	....	....	1in.	1in.	1in.	1in.	....	....
Upper	1in. amidships	1in. amidships	1in. amidships	1in. amidships	....	2in. to 4in. on slope	2in. to 6in. on slope	1½in., 2in. to 4in. on slope	2in. to 4in. on slope	....	....
Main	....	....	....	....	....	1½in., 1in.	1½in. 1in.	1½in., 1in.	1½in., 1in.	....	....
Lower	1in. aft	1in. aft	1in. aft	1in. aft	....	....	....	....	....	....	....

TABLE I.—Continued

	Torpedo-boat destroyers			T. B. D. flotilla leaders		Patrol boats	Sloops and mine-sweepers			"China" gunboats	
	"M" class	"R" and "S" classes	"V" and "W" classes	Kempenfelt class	Scott class and Shakespeare class *	"P" class	Single-screw sloops. "Flower" class	Paddle mine-sweepers	Twin-screw mine-sweepers	"Fly" class	"Insect" class
Length between perpendiculars	265ft.	265ft.	300ft.	315ft.	320ft.	230ft.	255ft. 3in.	235ft.	220ft.	120ft.	230ft.
Length overall	273ft. 4in.	276ft.	312ft.	325ft.	332ft. 6in.	244ft. 6in.	267ft. 9in.	245ft. 9in.	231ft.	126ft.	237ft. 6in.
Breadth, extreme	26ft. 8in.	26ft. 8in.	29ft. 6in.	31ft. 9in.	31ft. 9in.	23ft. 9in.	33ft. 6in.	29ft. (58ft. over paddles)	28ft.	20ft.	36ft.
Load draft, mean	8ft. 8in.	9ft.	9ft.	10ft.	10ft. 6in.	7ft. 7in.	11ft.	6ft. 9in.	7ft.	2ft.	4ft.
Displacement in tons	1025	1065	1300	1650	1800	573	1250	810	750	98	645
Shaft horsepower of engines	25,000	27,000	27,000	36,000	40,000 to 44,000	4000	2400	1400	1800	175	2000
Speed at load draft, knots	34	36	34	34	36	22	17	15	16	10	14
Fuel at load draft, tons	140	150	185	255	250	50	130	....	....	....	....
Coal capacity, tons	....	....	....	....	....	....	260	150	140	5	35
Oil fuel capacity, tons	280	300	370	515	500	93	....	....	....	10	54
Armament	3 4in. 1 2-pdr.	3 4in. 1 2-pdr.	4 4in. or 4.7in. 1 3in.	4 4in. 2 2-pdrs.	5 4.7in. 1 3in. H.A.	1 4in. 1 2-pdr.	2 4in. or 4.7in. 2 3-pdrs.	1 3in. 1 6-pdr., 2 2-pdrs.	1 3in. 1 6-pdr., 2 2-pdrs.	1 4in. 1 3in. 1 6-pdr.	2 6in. 2 3in.
	4 21in. T.T.	4 21in. T.T.	4 or 6 21in. T.T.	4 21in. T.T.	6 21in. T.T.	2 14in. T.T.	....	....	....	....	....

* Approximately same.

TABLE I.—Continued

	Submarines					
	"E" class	"G" class	"H" class	"J" class	"K" class	"L" class
Length between perpendiculars	180ft.	185ft.	164ft. 6in.	270ft.	334ft	222ft.
Length overall	181ft.	187ft.	171ft.	275ft.	338ft.	231ft.
Breadth, extreme	22ft. 6in.	22ft. 6in.	15ft. 9in.	23ft.	26ft. 6in.	23ft. 6in.
Load draft, mean	12ft. 6in.	13ft. 3in.	11ft. 3in.	14ft.	16ft.	13ft. 6in.
Displacement in tons, surface	660	700	440	1210	1880	890
Displacement in tons, submerged	800	975	500	1820	2650	1070
Shaft horsepower of engines, surface	1600	1600	480	3600	10,000	2400
Shaft horsepower of engines, submerged	840	840	320	1350	1400	1600
Speed at load draft, knots, surface	15	14	13	19	24	17½
Speed at load draft, knots, submerged	10	10	10½	9½	9	10½
Oil fuel capacity, tons	45	44	16	91	200	76
Armament	1 3in. 5 18in. T.T.	1 3in. 4 18in., 1 21in. T.T.	.... 4 21in. T.T.	1 3in. or 4in. 6 18in. T.T.	1 4in., 1 3in. H.A. 8 18in. T.T.	1 3in. or 4in. 6 18in. T.T.

From "Naval Construction during War," by Sir Eustace Tennyson D'Eyncourt, K. C. B.; read before Institution of Naval Architects, April 9, 1919.

UNITED STATES

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

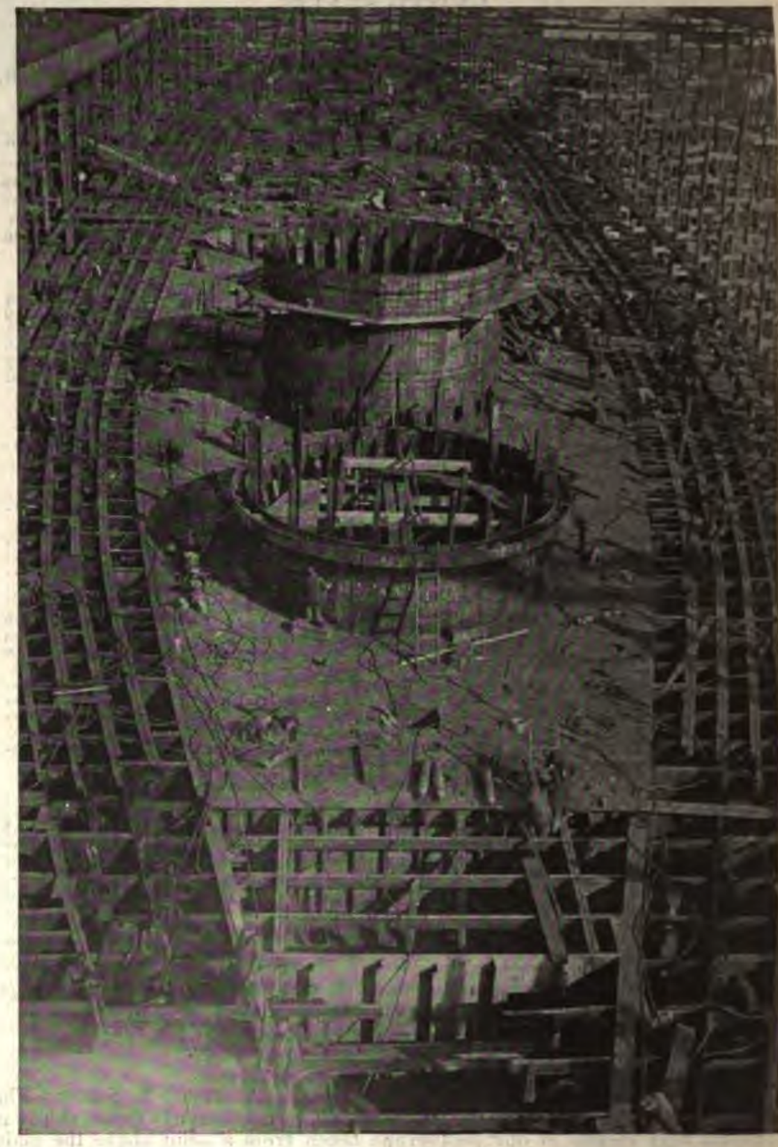
VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, APRIL 30, 1919

Type, number and name	Contractor	Per cent of completion			
		May 1, 1919		Apr. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
43 Tennessee	New York Navy Yard	72.6	68.6	68.4	64.4
44 California	Mare Island Navy Yard	59.9	48.9	57.2	45.9
45 Colorado	New York S. B. Co	20.4	3.4	16.4	2.1
46 Maryland	Newport News S. B. & D. D. Co	45.9	35.9	44.1	34.6
47 Washington	New York S. B. Co	18.5	2.8	12.4	1.7
48 West Virginia	Newport News S. B. & D. D. Co	21.3	2.2	20.5	2.2
49 South Dakota	New York Navy Yard	0.	0.	0.	0.
50 Indiana	New York Navy Yard	0.	0.	0.	0.
51 Montana	Mare Island Navy Yard	0.	0.	0.	0.
52 North Carolina	Norfolk Navy Yard	0.	0.	0.	0.
Battle Cruisers					
1 Lexington	Fore River S. B. Co	....	....	....	....
2 Constellation	Newport News S. B. & D. D. Co	....	....	....	....
3 Saratoga	New York S. B. Co	....	....	....	....
4 Ranger	Newport News S. B. & D. D. Co	....	....	....	....
5 Constitution	Phila. Navy Yard	....	....	....	....
6	Phila. Navy Yard	....	....	....	....
Scout Cruisers					
4	Todd D. D. & Const. Co	26.2	2.9	25.	1.6
5	Todd D. D. & Const. Co	24.3	2.5	22.5	1.4
6	Todd D. D. & Const. Co	20.1	1.	18.2	.9
7	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
8	Beth. S. B. Co. (Fore River)	0.	0.	0.	0.
9	Wm. Cramp & Sons Co	10.	....	9.	....
10	Wm. Cramp & Sons Co	10.	....	9.	....
11	Wm. Cramp & Sons Co	0.	....	0.	....
12	Wm. Cramp & Sons Co	0.	....	0.	....
13	Wm. Cramp & Sons Co	0.	....	0.	....
Miscellaneous					
Fuel Ship No. 16 Brazos	Boston Navy Yard	93.1	92.6	91.	90.3
Fuel Ship No. 17	Boston Navy Yard	23.8	1.5	20.2	.5
Fuel Ship No. 18	Boston Navy Yard	.2	.2	.2	.2
Gunboat No. 21 Asheville	Charleston Navy Yard	81.3	79.3	78.7	76.7
Gunboat No. 22	Charleston Navy Yard	1.3	.3	0.	0.
Hospital Ship No. 1	Phila. Navy Yard	27.4	15.8	26.	12.5
Amn. Ship No. 1, Pyro	Puget Sound Navy Yard	86.	78.	80.	72.
Amn. Ship No. 2, Nitro	Puget Sound Navy Yard	38.	18.	32.	8.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	....	....	....	....

There are 185 destroyers, 69 submarines, 12 oil tankers, 19 sea-going tugs, 31 harbor tugs, and 52 Ford eagles in various stages of completion.

MATÉRIEL

PROTECTION AGAINST TORPEDOES AND MINES LATEST U. S. SHIPS.—The remarkable character of the underwater protection of these ships is shown very clearly in our photograph taken from a point above the main deck of the *Maryland*, which is now under construction at the Newport News shipyard. It will be seen that, between the outer skin of the ship and the inner wall enclosing the engine and boiler rooms, magazines, etc., there are no less than four longitudinal walls, intersecting the numerous transverse bulkheads and subordinate transverse partitions. Thus, there is provided, a broad belt, 12 to 15 feet in width, of cellular water-tight



DECK VIEW OF THE 32,300-TON "MARYLAND" SHOWS THE WIDE ANTI-TORPEDO, CELLULAR CONSTRUCTION, WHICH WILL ENABLE HER TO SURVIVE THE BLOWS OF SEVERAL TORPEDOES.

compartments. The force of the detonation of a torpedo would be expended in rupturing the tough steel of this construction, and its tearing and bursting energy would be so far absorbed that, by the time it reached the inner wall, it would fail to get through. The Germans adopted this construction in their ships to such good effect that when the battle-cruiser *Goeben* was taken over after the armistice, it was found that though she had been torpedoed or mined no less than five times, and although the innermost walls protecting the engine and boiler rooms were bulged inward, they had held. Similarly, although at least four of the German battleships were torpedoed at Jutland, they all succeeded in getting back to port for repairs.—*Scientific American*, 3/5.

PERSONNEL

REDUCTION OF NAVAL FORCE ORDERED.—The Secretary of the Navy has directed that the total enlisted personnel, regular and reserves, be reduced to 250,000 prior to July 1, 1919; that a material reduction be immediately made in the enlisted personnel now employed on shore, and that in making this reduction personnel relieved from shore duty shall not be released, but shall be sent to sea. Accordingly, the bureau of navigation has issued orders to the commandants of all naval districts to make reductions in their forces and has directed the transfer of certain personnel to the larger receiving ships for detail to sea-going vessels.—*Army and Navy Register*, 5/10.

SHORTAGE OF MEN IN NAVY.—The Bureau of Navigation is confronted with the serious problem of finding enough men to maintain depleted crews for the vessels of the fleet and to meet the constantly increasing demands, with a woeful insufficiency of men wherewith to work. The plan of placing a large number of vessels out of commission was considered, but it is understood that this proposal has not met with favor in the office of operations. Meanwhile the demand for more men is becoming urgent and insistent. When the U. S. fleet arrived in New York there was an immediate call for 7000 regulars, and there were but about 600 to furnish the fleet. Only recently 18 mine sweepers were fitted out for duty in European waters, a duty which is generally recognized as being hazardous and free from romance, and consequently calls for men who are trained in the regular navy and may be expected to remain until the job is finished. Three salvage vessels were also equipped for work which the reservist, no matter how enthusiastic, is not qualified to perform. The Eagle boats are coming apace, the first vessels being assigned immediately to an important detail in European waters.—*Army and Navy Register*, 4/26.

OPERATIONS

SWEEPING UP AMERICAN MINES.—Eighteen mine sweepers and from 1700 to 1800 men will be employed under Rear Admiral Strauss in sweeping up the 57,000 American mines which were laid in the great North Sea barrage during the war. Two of the craft are now overseas, 12 others are now en route and the last four will sail from Boston. In addition to the sweepers, 20 of the gasoline-driven submarine chasers now in European waters have been assigned as tenders.

The sweepers are powerful seagoing tugs, built for this special duty. They are single-screw, oil-burning craft of about 1000 tons' displacement, and each has a complement of five officers and 75 men. Some of them have already demonstrated their fitness by sweeping up mines planted on the American coast by German submarines. Their steaming radius is such that they can remain at sea many days engaged in this rough and dangerous work.—*Army and Navy Register*, 4/26.

MERCHANT MARINE

WILL CANCEL SHIP CONTRACTS.—*Shipping Board to Reduce Engagements by 2,000,000 Tons.*—In a statement issued Friday, April 25, Chairman Hurley, of the United States Shipping Board, said:

"Since the signing of the armistice on November 11, 1918, the Shipping Board has cancelled contracts for more than 2,000,000 tons of steel ships.

"In figuring out the balancing of our fleet, we now find it necessary to cancel an additional 2,000,000 tons of steel ships.

"In some of the old and established yards we are now paying from $195 to $225 per ton for cargo steamships and oil tankers. In some of the new and inexperienced yards we are paying as high as $300 per ton for cargo ships.

"As these are war prices and as we feel that we should now be building only on peace prices, we are now considering cancelling all contracts where keels have not actually been laid."—*Official Bulletin*, 5/5.

REPORT AMERICA GETS SEIZED SHIPS.—The retention of the seized German ships by the United States would place at its command permanently such vessels as the *Leviathan*, formerly known as the *Vaterland*. Vessels of this type would be of tremendous service in building up passenger lines on the most efficient basis and by so doing draw freight business.

It was stated in the news dispatch from Paris that the German interests would be credited with a fair price for the tonnage when reckoning was made of the damage done by the German submarines to American tonnage and American interests.

It is considered possible here that the action of the Alien Property Custodian's office in buying the seized North German Lloyd and Hamburg American docks at Hoboken, thus assuring the temporary retention of their control in the government, may have had something to do with a decision at Paris to award the German shipping seized in American ports to the United States.

Here is a list of the former German-owned shipping seized in American ports and which is reported to be involved in the decision made at Paris. The tonnage figures are in relation to the usefulness of the ships as cargo carriers and is reckoned without regard to the passenger service which will be rendered:

Name	Tonnage	Name	Tonnage
Actalon	7,200	*Coosa*	2,485
Aeolus	12,305	*Covington*	11,717
Agamemnon	8,700	*Baron de Kalb*	8,200
America	20,765	*Freedom*	6,800
Amphion	8,950	*Gen. G. W. Goethals*	5,437
Andalusia	8,000	*Gen. H. F. Hodges*	4,069
Antigone	11,000	*Gen. O. H. Ernst*	5,380
Apelles	11,200	*Gen. W. C. Gorgas*	5,520
Arcadia	7,100	*G. Washington*	13,300
Argenia	7,600	*Gulfport*	4,334
Artemis	11,500	*Honolulu*	8,000
Ascutney	6,700	*Houston*	4,800
Astoria	4,650	*Huron*	11,000
Bath	3,978	*Iosco*	1,800
Beaufort	2,600	*Isonomia*	5,050
Black Arrow	8,000	*Kittery*	1,690
Bridgeport	10,000	*Leviathan*	15,000
Camden	9,761	*Long Beach*	1,967
Casco	7,200	*Madawaska*	6,850
Chattahoochee	11,000	*Mercury*	10,350

Name	Tonnage	Name	Tonnage
Midget	600	*Quinnebaug*	2,000
Moccasin	4,760	*Rajah*	[illegible],250
Monticello	12,500	*Rappahannock*	11,200
Montpelier	10,000	*Raritan*	1,600
Mount Vernon	8,300	*Sachem*	4,246
Nansemond	14,700	*Savannah*	6,930
Neuse	6,800	*Susquehanna*	11,650
Newport News	5,270	*Suwanee*	11,250
Nipsic	2,500	*Tacony*	2,200
Nyanza	7,750	*Ticonderoga*	7,900
Oconee	4,200	*Tippecanoe*	8,966
Orion	5,800	*Tunica*	7,750
Osage	7,600	*Von Steuben*	6,000
Otsego	6,470	*Wabash*	6,775
Owasco	5,180	*Wachusett*	6,450
Pawnee	6,500	*Wacouta*	3,400
Pensacola	6,040	*Wamsutta*	2,172
Pequot	8,879	*Watauga*	1,900
Philippines	13,000	*Wyandotte*	5,900
Pocahontas	10,550	*Yadkin*	2,510
Powhatan	9,510	*Yazoo*	2,200
President Grant	19,810	*Yucca*	4,416
President Lincoln	21,000	*Yuma*	2,500
Princess Matoika	10,500		
Quantico	2,900		
Quincy	5,100	Total, 89 ships	654,000

The names given are those selected by the United States.—*N. Y. Times,* 5/6.

NAVIGATION AND RADIO

RADIO TELEPHONY

BATTLESHIP EQUIPMENT.—The possibilities of the wireless telephone in naval maneuvering were quickly recognized by the Navy Department. Commander Hooper, of the Bureau of Steam Engineering, asked us to cooperate in making the wireless telephone a useful piece of equipment in naval service. It was decided to build two experimental sets, install them on battleships and give the operating staff an opportunity to investigate and criticize them from an operating point of view. The construction of two sets was begun in December, 1915, and they were completed about the middle of January. A short description of these sets will not be out of place at this time. Each set consisted of complete transmitting and receiving sets with a motor-generator. The receiving set was built to be set on top of the transmitting set. An extension circuit was provided so as to allow placing the hand set either on the bridge or in the admiral's or captain's cabin so that it would not be necessary for them to go to the radio room to talk. A duplicate hand set was provided for the operator in the radio room, as well as a head telephone for listening-in. The normal condition of the circuit was with the antenna connected to the receiving set. Any call thus coming in would be received. When a call was received and it was desired to talk instead of to listen, a button on the hand set was pressed which caused the relay operated antenna switch to disconnect the antenna from the receiving set and connect it to the transmitting set and at the same time start the transmitting set operating. This operation required only a fraction of a second. It was thus possible to transmit and receive successively on the same antenna by pressing the

button whenever it was desired to talk. The wave length range of the set was 600 to 1200 meters. This system was likewise similar to that at Arlington, but was, of course, quite small and produced only one and one-quarter amperes in the antenna. These sets were installed on the battleships *Arkansas* and *Florida* at Guantanamo, Cuba, the first part of February, 1916. It was found entirely practicable to hold a two-way conversation between vessels over 30 miles apart. There is no reason to think that was the limit of communication, as some of these conversations were overheard in Jamaica, a distance of 175 miles. No attempt was made for range, as that was not the object in building these sets.

Multiplex Working.—This experiment pointed out many things in the use of the wireless telephone which it was highly desirable to know. As the result, the Bureau of Steam Engineering approached us later in the same year and requested that a second step be made in the development of a satisfactory set. The fact that this set worked on the same wave lengths as their regular radio telegraph sets, caused considerable interference. It was desired in the telephone field to provide separate possibilities in communication for the navy and not encroach upon the telegraph. It was, therefore, thought desirable to go to much shorter wave lengths and provide a set which would not interfere at all with the telegraphic operation of neighboring vessels and interfere very little with the telegraphic operations on the same vessel on which the telephone was being used. A few field experiments were made with short wave antennas on two ships in July, 1916, to provide data necessary for building these sets and their design and construction was started in October. The new set differed from the old one in that it operated on three wave lengths, 150, 189, and 238 meters, and also in that it was multiplex and allowed nine conversations to be carried on three wave lengths. The basis of the multiplex system which was originated by Mr. R. A. Heising is as follows:

Suppose a wave of 25,000 cycles is modulated according to a speech signal. This wave when received in the receiving set and rectified reproduces the desired speech. If, however, instead of radiating this 25,000-cycle wave directly, we modulate a 150-meter wave with it and radiate the 150-meter wave, on receiving and detecting at the receiving station the 150-meter wave there will be produced the wave of modulation, or the 25,000 cycle wave. This second wave is, therefore, produced in the receiving station not by its direct radiation and reception, but is produced there by being carried by the shorter carrier wave. If it is then selected by tuned circuits and detected, the speech signal becomes audible. Therefore, with these sets provided, it was possible to have three ships transmit simultaneously on the same wave length, 150 meters for instance, one ship using an intermediate frequency of 25,000 cycles, the second an intermediate frequency of 35,000 cycles and the fourth, an intermediate frequency of 45,000 cycles. A receiving station tuned to 150 meters would receive all three double modulated waves. By using a second tuned circuit, one of the stations could pick out any one of these three conversations by tuning the second tuned circuit to 25,000, 35,000 or 45,000 cycles and detecting and would not be interfered with by the other two stations on the same wave length.

These sets were built upon the same plan as the previous ones in that transmitting and receiving sets were built to be placed one upon the other. These sets were installed on the U. S. S. *Pennsylvania*, *Wyoming* and *Seattle* in January, 1917, but scarcely had they been installed than diplomatic relations with Germany were severed and the assistance in the development of apparatus by the operating staff of the navy was necessarily curtailed.

Radio Telephone Apparatus for Military Use.—Beginning with the entry of this country into the war, the demands for radio apparatus for military purposes have resulted in the very rapid commercial development

of this type of equipment. While nothing fundamentally new has resulted from this work, there has been a very practical and valuable result in that the commercial development and manufacture of radio telephone apparatus in general has been put on a basis which otherwise could not have been reached for many years to come.

The first apparatus for war purposes was built at the request of the Navy Department in March, 1917, and consisted of 15 experimental sets which were proposed for use on submarine chasers. These sets were of the continuous wave type and were intended primarily for telegraph communication, but were also equipped with a telephone modulating attachment. The transmitting element employed four tubes of the type used in the transatlantic experiments, and delivered approximately 1.5 amperes into the small antenna of the submarine chaser. In view of the fact that these sets were immediately replaced by an improved type which will be described later, the detailed construction of these sets need not be discussed, and they are mentioned merely to indicate the Navy Department's practical interest in this type of apparatus at a comparatively early date.

Aircraft Telephony.—The most prominent and probably most spectacular development of radio telephony during the war was in connection with its use on military aircraft. While radio telegraphy had been used before for fire control and scouting purposes, its field had not gone beyond that of one-way communication, and was confined practically to the use of simple spark gap types of telegraph apparatus.

Anticipating possible employment of radio telephony in this field, the Western Electric Company Engineering organization had done a considerable amount of experimental work in the way of applying the principles demonstrated in connection with earlier experiments in long distance radio telephony to short range work. This work had been carried on for some time under the direction of Mr. H. W. Nichols, and had resulted in the development in experimental form of satisfactory short-range apparatus.

On May 22, 1917, Major General Squire, Chief Signal Officer of the Army, called a conference at Washington to consider the feasibility of intercommunication between airplanes while in flight by means of radio telephony. There were present at this conference besides General Squire, Colonel Rees, of the Royal Flying Corps of Great Britain; Captain, now Colonel, C. C. Culver, of the Signal Corps, and Major, later Lieutenant Colonel, F. B. Jewett, and Captain, later Major, E. B. Craft, who had been assigned from the Western Electric Company Engineering Organization to engage in this work. At this time plans were in the making for the tremendous aircraft program which was later undertaken by the army, and it was clear to all that a successful means of communication between battle planes when flying in squadrons would be of inestimable value and would greatly increase the efficiency with which these squadrons could be maneuvered. The early work had shown such promise that there was justification for assuring the Signal Corps that this means of communication could be worked out successfully and applied to aircraft of various types. As a result of this conference, orders were issued by the Signal Corps for the Western Electric Company to undertake the development of a wireless telephone system for the purpose. The experimental equipment available as a laboratory proposition at this time, served as a basis for the first experimental trials in the air. This transmitting set did not use the Colpitts system of modulation the "constant currents" system of R. A. Heising, which was found to be more compact and easily operated. This system comprises a modulator and an oscillator tube with their plate circuits essentially in parallel for audio frequency currents. They are supplied from a generator through a choke coil whose function is to maintain a practically constant current to the two tubes no matter

how the plate currents may vary individually. A circuit diagram is shown in Fig. 16, and the operation is as follows:

When the transmitter is not actuated there is a certain normal value of voltage impressed upon the grid of the modulator tube, this value being adjusted until the plate current of the modulator is about the same as that of the oscillator. Now the characteristic curve shows that as the grid becomes more negative the plate current decreases at constant plate voltage, and with positive grid voltage it increases. This may be described by saying that the resistance of the plate circuit may be varied by varying the grid voltage, and inspection of the curve shows that this variation may be from a very high value (point $-E$) to a small value for positive grid voltages. In the modulating system of Heising the transmitter voltage acts upon the grid of the modulator and causes the resistance of the plate circuit to vary through a wide range in accordance with the speech voltage. Since this circuit shunts the plate circuit of the oscillator tube (at audio but not at radio frequencies) the oscillator will

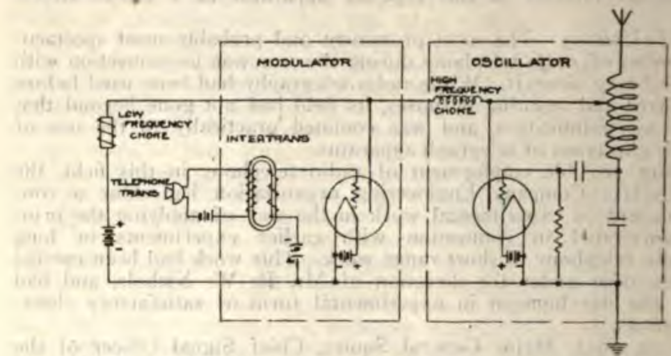


FIG. 16.—SCHEMATIC OF HEISING MODULATION SYSTEM.

be robbed of current or have additional plate current forced through it in accordance with the speech voltage. Its output will thus be varied and it has been found that speech is modulated in this way with very good quality. The efficiency of this system is high and greater than that of an "absorption" system in which power is variably diverted from an oscillating circuit and wasted in a modulating device. In the constant-current system the voltage and current in the oscillator rise periodically to nearly twice their values when the transmitter is not acting, which fact accounts for the increased efficiency.

Experimental Work.—This fundamental plan seemed to be the most feasible one to pursue, and on June 5, 1917, another conference was held at Washington to agree upon the various technical features and make plans for carrying out field tests.

It was early realized that the principal difficulty in airplane telephony would be the noises due to the motor and the wind, so that attention was concentrated on the problem of providing against this difficulty both in the transmitting and receiving ends of the combination. Laboratory work was directed particularly toward producing a form of telephone transmitter or microphone which would be as insensitive as possible to these extraneous noises and at the same time be responsive to the voice frequencies. In order that this work might be carried on at high speed sound-proof room was constructed and a device provided which rep duced very accurately the noises of the engine exhaust. By the first

July experiments looked sufficiently promising to warrant tests in the field. On July 2d a complete radio telephone transmitting equipment was taken into the air and speech of good volume and quality was received on the ground, with the transmitting plane two miles away. The development of a suitable receiving head set was carried on simultaneously, and it was found possible to devise a leather helmet with the receiving elements so disposed and screened from external noises that the weak radio signals could be readily observed. On July 4th experimental receiving equipment was taken into the air, and Mr. L. M. Clement, of the Western Electric Company, successfully received speech from the ground at a distance of several miles.

As stated before, the apparatus used in these tests was of an experimental form built in the laboratory. The transmitting set had an output of 0.7 amperes at a wave length range of 200 to 400 meters, the antenna being a trailing wire about 100 meters long.

Development of Apparatus.—With the information resulting from these tests, the development of a practical airplane set began at once. During the previous month, comparative tests had been made on a number of proposed modulating systems, with the result that the constant-current system previously described seemed best for the purpose. The problem now was to produce sets of minimum size and weight, physical structures which would withstand the extreme vibrations and jars encountered in flying, especially in landing, the most convenient disposition of control elements, suitable source of power for both high and low voltage, and a form of antenna which would not interfere with the evolutions of a plane in squadron formation.

It was realized that the solution of the last-mentioned problem would consume more time than was at our disposal, and while work was immediately started in the field on antenna measurements and study, the design of the sets proceeded on the basis of using a trailing wire antenna.

The working out of a practical helmet design proved to be more difficult than the success of the earlier experiments indicated. It was found that the degree of interference experienced changed very rapidly with slight imperfections to fit. The problem was also complicated by the necessity of providing means for using oxygen at high altitudes, and of providing for the comfort of the wearer over a period of several hours. It was found that a very slight amount of pressure on certain portions of the ear caused excessive pains and headaches after a very short period, and the final design was a compromise between comfort and efficiency as to sound insulation.

The problem of power supply was an interesting one. It was required that the weight should be reduced to a minimum, which precluded the possibility of employing storage batteries. There are obvious objections, also, to attaching any form of generating device to the propelling engine. Consideration of all the factors led to the adoption of a wind-driven generator for the purpose. This generator of about 100 watts direct current output was required to produce a potential of 300 volts for the plate circuits of the vacuum tubes, and a potential of 25 volts for the filament circuits. It is necessary, to insure most efficient operation, that the filament current be kept constant, and the fact that the specifications called for operation with airplane speeds varying from 40 to 160 miles per hour made the problem of voltage regulation loom large. Ordinary forms of electro-mechanical regulating devices did not prove to be successful, and while it was probable that something of this type would eventually have been developed, the problem was solved by a very ingenious arrangement proposed by Mr. H. M. Stroller, in which the vacuum tube is the essential element. The voltage of the generator is held approximately constant by means of a vacuum tube regulator, which controls the field flux. Two field windings are provided, the main field, which is in series with the

filament of the regulator tube, and a differential field which is in series with the plate circuit. At minimum speed the differential field is inactive and the generator behaves like an ordinary shunt machine, except that the main field has a small resistance in series due to the regulator tube filament. This filament is so designed that the main field current heats it to a temperature which gives a small electron current. This current flows through the differential field and reduces the resultant flux. At minimum speed, the differential current is small, but as the speed increases, the main field current tends to rise (as in any shunt generator) and this increases the temperature of the regulator tube filament. The electron current is, therefore, considerably increased, which current, flowing through the differential field, reduces the generator flux and thus restricts the rise in voltage. Due to the fact that the electron current of the regulator tube increases very rapidly with increase in filament current, the voltage is held practically constant between 4000 and 12,000 rev. per min. The 1.5-ohm resistance units are provided so that the regulator may be set to give different voltages by cutting them in or out of the main field. The 100 ohms shunt resistance is used to prevent hunting.

Upon the completion of the next set of models, field tests were resumed and on August 20th the first two-way telephone conversation between two planes in the air was successfully accomplished. After this first trial, Major Hertholf and Lt. Stevens of the Signal Corps held two-way conversation between planes with very satisfactory results.

At this time two general schemes of control were considered—manual means for transferring from the transmitting to the receiving position, and automatic means for accomplishing the same result through the operation of a remote control relay. It was concluded, because of its simple construction, to employ the manual means of control, the idea being to locate the set in the observer's position in the plane.

On August 22d an informal demonstration of talk from airplane to ground was given for Secretary of War Baker, General Scott, and Colonel Baker. These experiments conclusively demonstrated the practicability of the system and apparatus, and we felt justified in proceeding with its commercial development.

COMMERCIAL DEVELOPMENT

Vacuum Tubes.—While the vacuum tubes that had been developed in the 1915 and 1916 experiments were satisfactory in operation under normal conditions, it was found that the mechanical vibration encountered in the air was such as to necessitate special structures to withstand them. New forms of vacuum tubes, which successfully met these requirements were developed.

The vacuum tubes used in all this work were of the so-called "Wehnelt Cathode" type; that is, the electron-emitting cathode consisting of a metal filament—usually platinum—coated with a mixture of oxides which, when heated to a moderate temperature, give off electrons in great numbers. When properly constructed and treated, such a type has several great advantages:

1. For a given electron emission, the temperature is not so near the point of destruction due to evaporation, etc., as in the case of a pure metal—for instance, tungsten. The result is longer life in operation.
2. For a given change in filament current at working ranges the change in electron emission is smaller in the case of the Wehnelt cathode, permitting of closer regulation in power output.
3. Evaporation of the filament does not go on so rapidly, consequently its electrical behavior is more uniform throughout its life.
4. The electron emission for a given amount of energy supplied to the cathode is larger, resulting in more economical operation of the sets.

It was found that for transmitting and receiving purposes, two types of tube were sufficient. The tube for receiving purposes was designated as VT1 by the Signal Corps and as the CW933 by the navy. A transmitting tube capable of delivering a moderate amount of power—say from 3 to 5 watts high-frequency output—was known as the VT2 by the Signal Corps and as the CW931 by the navy. Vacuum tubes are defined, as far as electrical characteristics in normal operation are concerned, by plate and filament voltages, plate current with normal plate voltage and zero grid voltage, normal filament current, filament life at this current, and by what is known as the amplification constant, which is approximately the ratio, μ, of that change in plate voltage which produces a given change in plate current to the change in grid voltage to produce the same change in plate current.

As indicating some of the problems involved in the commercial production of this entirely new type of equipment, it is interesting to note that prior to August, 1917, the total output of commercial vacuum tubes of this general type was approximately 200 per week, their use being practically confined to long-distance wire telephony and to radio detection purposes. On November 11, 1918, deliveries were being made at the rate of 25,000 per week. This involved the organization of equipment and personnel to do a class of work for which there was practically no experienced talent available and the situation in many features was analogous to that in connection with airplane production.

Apparatus.—Tests of the first standardized sets for Signal Corps use were made at Langley Field on October 6. These sets operated very successfully and official demonstrations of two-way communication were made. This set was made up of a combined control panel and receiver with two stages of amplification and a separate transmitting set, the electrical connections being made by flexible cords. By means of the multi-contact manual switch located on the control panel, the operator can receive or transmit as desired. The receiver consists of a single tuned circuit of the very simplest type and the amplifier is made adjustable for the convenience of the observer.

While the original requirement was that communication should be maintained at a distance of 2000 yards, all of the tests indicated that successful communication could be obtained at much greater distances. On October 16 an official distance test was made, and communication between planes was maintained at a distance of 23 miles, and from plane to ground, 45 miles. The conditions under which these tests were made were extremely favorable, and are noted merely to show the possibilities of this particular equipment. The figure that was finally established as being representative of what would be required in service was three miles.

A number of sets were immediately constructed, and complete equipment sent overseas with Signal Corps Officers, where they were submitted for the criticism of our military forces.

Several more demonstrations of this apparatus were made, culminating in the official trials at Dayton, Ohio, on December 2, 1917. There were present members of the Aircraft Production Board and the joint Army and Navy Technical Board, and various Signal Corps officers. The demonstration consisted of a three-cornered conversation between two planes in the air and a ground station. At the ground station a loud-speaking receiver was connected to the radio, set in such a way that the entire party of about thirty could overhear the conversation between the fliers and also the speech between the planes and the ground. Under orders transmitted from the ground station, the fliers performed various evolutions in the air, and the observers could see these orders carried out and hear the acknowledgments. In these tests the pilot and observer in each plane were also connected, so that there were five people in constant communication. The maximum distance of the planes from the ground

button whenever it was desired to talk. The wave length range of the set was 600 to 1200 meters. This system was likewise similar to that at Arlington, but was, of course, quite small and produced only one and one-quarter amperes in the antenna. These sets were installed on the battleships *Arkansas* and *Florida* at Guantanamo, Cuba, the first part of February, 1916. It was found entirely practicable to hold a two-way conversation between vessels over 30 miles apart. There is no reason to think that was the limit of communication, as some of these conversations were overheard in Jamaica, a distance of 175 miles. No attempt was made for range, as that was not the object in building these sets.

Multiplex Working.—This experiment pointed out many things in the use of the wireless telephone which it was highly desirable to know. As the result, the Bureau of Steam Engineering approached us later in the same year and requested that a second step be made in the development of a satisfactory set. The fact that this set worked on the same wave lengths as their regular radio telegraph sets, caused considerable interference. It was desired in the telephone field to provide separate possibilities in communication for the navy and not encroach upon the telegraph. It was, therefore, thought desirable to go to much shorter wave lengths and provide a set which would not interfere at all with the telegraphic operation of neighboring vessels and interfere very little with the telegraphic operations on the same vessel on which the telephone was being used. A few field experiments were made with short wave antennas on two ships in July, 1916, to provide data necessary for building these sets and their design and construction was started in October. The new set differed from the old one in that it operated on three wave lengths, 150, 189, and 238 meters, and also in that it was multiplex and allowed nine conversations to be carried on three wave lengths. The basis of the multiplex system which was originated by Mr. R. A. Heising is as follows:

Suppose a wave of 25,000 cycles is modulated according to a speech signal. This wave when received in the receiving set and rectified reproduces the desired speech. If, however, instead of radiating this 25,000-cycle wave directly, we modulate a 150-meter wave with it and radiate the 150-meter wave, on receiving and detecting at the receiving station the 150-meter wave there will be produced the wave of modulation, or the 25,000 cycle wave. This second wave is, therefore, produced in the receiving station not by its direct radiation and reception, but is produced there by being carried by the shorter carrier wave. If it is then selected by tuned circuits and detected, the speech signal becomes audible. Therefore, with these sets provided, it was possible to have three ships transmit simultaneously on the same wave length, 150 meters for instance, one ship using an intermediate frequency of 25,000 cycles, the second an intermediate frequency of 35,000 cycles and the fourth, an intermediate frequency of 45,000 cycles. A receiving station tuned to 150 meters would receive all three double modulated waves. By using a second tuned circuit, one of the stations could pick out any one of these three conversations by tuning the second tuned circuit to 25,000, 35,000 or 45,000 cycles and detecting and would not be interfered with by the other two stations on the same wave length.

These sets were built upon the same plan as the previous ones in that transmitting and receiving sets were built to be placed one upon the other. These sets were installed on the U. S. S. *Pennsylvania*, *Wyoming* and *Seattle* in January, 1917, but scarcely had they been installed than diplomatic relations with Germany were severed and the assistance in the development of apparatus by the operating staff of the navy was necessarily curtailed.

Radio Telephone Apparatus for Military Use.—Beginning with the entry of this country into the war, the demands for radio apparatus for military purposes have resulted in the very rapid commercial development

if an efficient system is to be used, and steps were taken to design such a set. There is no difficulty in securing extremely short waves with the vacuum tube oscillator, but there is some difficulty in designing a very compact set, with wave length adjustable over a considerable range and containing amplifiers and modulators, and at the same time avoiding excessive losses. In October, 1917, some laboratory sets were made for wave lengths of the order of 70 to 150 meters, and early in 1918 the Signal Corps requested the development of a short wave set. This was built in April and was electrically essentially the same as the longer wave sets except for minor changes due to the use of higher frequencies of the order of 4,000,000 cycles.

Trials of this system were made at Camp Alfred Vail at wave lengths of 60 meters and above. The antenna first used was a very short structure on the top of the plane with two wires extending to the tail. This antenna had a natural wave length of 32 meters and a resistance of only one ohm. To increase the radiating qualities the rear portion of the antenna was raised and the resistance thereby brought up to nearly three ohms at 75 meters. This structure did not materially increase the head resistance of the plane and did not interfere with its operation. As described later, this form of antenna was soon replaced by another.

The use of short wave lengths brings forward prominently the problem of location of component parts of the set in the plane, for a few unnecessary feet of connecting wire carrying these high frequency currents may cause the failure of the set. For this reason considerable thought was given to the question of location of transmitter and control box.

Radiating Systems.—The whole subject of proper radiating systems for use on planes was one to which more time should have been applied than was available at the time of development and manufacture of the first apparatus. A considerable amount of work, however, was carried on and valuable data obtained. This work was started in the summer of 1917 at Langley Field, and was later transferred to Camp Alfred Vail, N. J. The work was in charge of Mr. A. A. Oswald, of the Western Electric Co., under the direction of the Signal Corps, and resulted in the accumulation of a considerable amount of useful data on many types of antenna. There are three important conditions to be met in designing an antenna for use on airplanes.

1. It must be an efficient radiator.
2. It must not be directive.
3. It must not interfere with complicated evolutions of the plane.

The third condition practically prohibits the use of a long trailing wire with a weight, because of the danger of fouling the propeller. This type of antenna is also quite directive.

The details of this antenna investigation should properly be covered in a separate paper. It may be well to state, however, that the best system, all things considered, was found to consist of two short unweighted wires, one from each wing tip. The two wires were joined in parallel above the fuselage, and worked against the conducting portions of the plane as a counterpoise. It was found that the use of one such wire as antenna and the other as counterpoise was not good.

Ignition Interference.—Another problem arose when sets began to be installed. This was that of noise in the receiving sets due to the engine ignition, and was very serious in some cases. Its solution was complicated by the fact that it was not allowable to alter the plane equipment in any way, for instance by changing the position of one magneto to secure greater shielding, but it was found that by covering the ignition wires with a flexible conducting tube grounded at intervals this trouble could be practically eliminated.

It was found that in some cases the ignition spark started in the ignition system high-frequency oscillations which were of proper frequency to

affect the receiver. This happened on the submarine chasers, which are driven by gasoline engines, and the trouble was remedied by inserting small iron core choke coils in the ignition leads to change the frequency of the oscillations. It is obvious that the "radio signals" sent out by the ignition spark are many millions of times more intense than those to be received, and it is remarkable that they do not entirely prevent reception. As a matter of fact, successful airplane telegraphy has been carried on in an experimental way, by using the ignition magneto as a radio transmitter.

Submarine Chaser Equipment.—During the war important use has been made of the wireless telephone in connection with naval work. Small 110-foot craft had been largely employed in connection with anti-submarine operations. In order to make the most effective use of the various listening devices, and to co-ordinate the operations of the various units, it is very necessary that instantaneous and direct communication be established at all times. Under the direction of the Special Submarine Board of the Navy Department, modified forms of radio telephone equipment were developed for this purpose. Early in November, 1917, the first practical trials were made, and satisfactory operation between chasers approximately five miles apart was obtained. These trials demonstrated the extreme value of this means of communication and sample equipments were immediately dispatched overseas for further trials under actual war conditions.

The circuits of this set are practically the same as the airplane equipment, except that power is obtained from small dynamotors operated from the 30-volt storage batteries with which the chasers are equipped. The set itself was located in the radio room, where it could be attended to by the regular radio operator. A telephone transmitter and receiver is, however, located in the pilot house so that the commanding officer can hold direct conversation with other vessels. The radio operator monitors the conversation and performs all tuning operations, thus leaving the commanding officer free to use the radio telephone as an ordinary wire line, except that he must press a button located at the side of the telephone when talking. The ordinary telephone head set is supplemented by a loud-speaking telephone receiver, which makes it possible for incoming signals to be heard without the use of head gear. To provide sufficient energy for operating the loud-speaking receiver a three-stage amplifier connected to the output side of the radio set is required. It is possible to connect the receiving portion of the radio set to either the ordinary head receiver or to the amplifier with its loud speaker.

This equipment has an effective operating range of about ten miles when used on the 110-foot submarine chasers. One feature not incorporated in the airplane sets consists of a wave length control gear by means of which the set can be operated on any one of five different wave lengths, ranging from 250 to 600 meters. This permits of a certain amount of selective operation within a chaser squadron.

A number of problems were met with in connection with this particular application not the least of which was the suppression of electrical disturbances in the antenna system due to the ignition system of the three propelling engines. Several thousand of these sets have been produced, and practically all submarine chasers sent overseas have been equipped with this apparatus. This apparatus is also being used for short range work on other types of naval vessels, with eminently satisfactory results. Modifications of the airplane type of equipment have also been made for use on naval seaplanes. For some classes of service the demand for longer range work has made necessary the employment of more powerful types of vacuum tubes.

The foregoing covers the most extensive application of vacuum tube radio telephony, the same general type of circuit and apparatus being used for short range telephony and telegraphy on land and water and in

the air. For reasons already mentioned, quantity production has been limited to the earlier models, in spite of the fact that investigations carried on during production have indicated many changes which would improve the electrical and mechanical efficiency of the apparatus.

The Future of Radio-Telephony.—The possibility of communication by speech between any two individuals in the civilized world is one of the most desirable ends for which engineering can strive. For this reason it is particularly desirable to form some opinion of the part which radio telephony may play in securing this universal service. It is clear that the elimination of the Morse operator, which is accomplished by the use of radio telephony rather than radio telegraphy, is necessary for universal and direct communication.

Radio telephony and wire telephony offer several sharp contrasts. The latter requires fixed channels of communication whose construction and maintenance necessitates an accessible path between stations, but the results obtained include secrecy, power efficiency, selection of a desired station and freedom from interference. A large item of expense is the line. On the other hand radio telephony requires neither fixed nor accessible channels and no cost at all for line construction and maintenance, but it is non-secret in the practical sense of the word, its power efficiency is low, selection is at present not practicable except in a limited way by wave length, and freedom from interference is not at present an attained fact. Thus while the two systems may be contrasted, they are not comparable, but each is useful in its own field. It is easy to see that radio telephony can never compete with wire telephony in densely populated districts, while wire telephony is a physical impossibility at sea and in the air. Fortunately, however, the connection of a wire system to a radio system is no more complicated than connecting two wire lines by means of a repeater, and, therefore, these two fields, although distinct, are adjacent. Leaving aside for the moment the particular methods by which radio telephone communication is to be carried on, it is clear that the establishment of communication between two given individuals will be most efficiently realized through the use of a combination of wire transmission on a network extending over perhaps 99 per cent of the stations and radio transmission to those relatively few stations to which it is either impossible or impracticable to build lines. These stations will be of two kinds:

1. *Moving,* such as ships, airplanes, trains, trucks.
2. *Fixed but inaccessible,* such as on islands, in deserts and in very sparsely settled regions.

A third class of service is that which is concerned, not with single individuals, but with groups; such service as the broadcasting of news, time and weather signals, and warnings. In some cases one objection to radio telephony would be an advantage in this class of service.

The choice of the particular kind of transmitting apparatus which will ultimately be used in thus extending the range of communication will involve careful consideration of costs and other engineering factors; its feasibility has, however, been conclusively demonstrated.—*Radio Telephony.* By E. B. Craft and E. H. Colpits. (Presented before A. I. E. E.)

NAVY RADIO COMPASS STATIONS.—In addition to the 33 United States Navy radio compass stations already established on the Atlantic and Gulf coasts, the Navy Department has authorized the establishment of 19 such stations on the Pacific coast. These are to be located to cover the entrances of Puget Sound, the Columbia River, Los Angeles, San Diego and San Francisco, which is to be equipped with four stations. The Atlantic coast stations are located at Cross Island, Bar Harbor, Damiscove Island and Appledore Island, Me., Gloucester, Deer Island, Fourth Watch Hill, R. I.; Montauk Point, Fire Island and Rockaway Beach, N. Y.;

Sandy Hook, Mantoloking and Cape May, N. J.; Cape Henlopen and Bethany Beach, Del.; Hog Island, Smith Island and Cape Henry, Va.; Cape Hatteras, Cape Lookout, Cape Fear, North Island, Bull Island and Morris Island, S. C.; St. Augustine and Key West, Fla. The gulf stations are at Burrwood, Pass a Loutre and Grand Island, La.—*Naval Monthly*, May.

The recent developments of wireless telegraphy have required the use of more powerful Hertzian waves than had been sent out by any station up to the time of the war. There are present, therefore, in the ether permeating and surrounding the atmosphere, numerous trains of waves traveling in all directions. It is altogether possible that one of these sets or a set resulting from a combination of several of them should come in contact with a number of conducting bodies so arranged in a casual manner as to form a Hertzian resonator of the required inductance, capacity and resistance to respond to the passing train. There would then be an ether wave excited in the system, a spark would be produced and a fire probably caused as the result of the passage of the wave.

Mr. George A. Le Roy has presented to the Académie des Sciences a note on the possibilities of a fire being produced in this manner. He conducted a laboratory investigation by means of an apparatus which he terms "inflammatory-resonator." It consists of a globular glass flask provided with four openings, two lateral, one at the top and one at the bottom. Through the lateral openings two electrodes are introduced and kept at the desired distance apart by an adjusting mechanism; they constitute the terminals of a Hertzian resonator. The bottom opening permits placing under the electrodes a plate which carries the inflammable substances; there is also at the bottom a connection for exhausting air with a pump, or introducing gases into the globe. Through the top are located the required measuring instruments.

Hertzian waves of relatively low intensity, generated by means of an ordinary Ruhmkorff coil, were sent through the instrument.

Mr. Le Roy asserts that iron electrodes facilitated the inflammation of cotton, amadou, paper, tow, etc. He, therefore, concludes that a condition may be produced in such a case as the piling of a number of cotton bales, when by the breaking of one of the iron bracings an open resonator is virtually formed.—*Mechanical Engineering*, May.

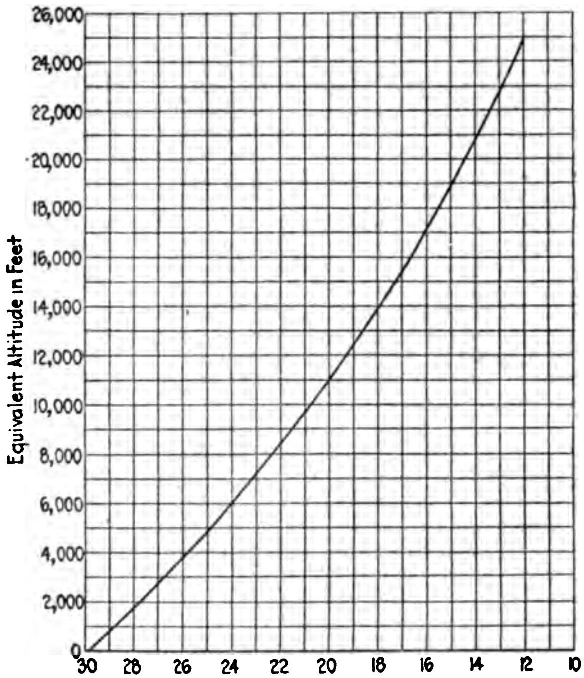
ENGINEERING

MEANS FOR INCREASING POWER OUTPUT OF AIRCRAFT ENGINES AT HIGH ALTITUDES.—*Maintaining Constant Pressure Between the Carburetors of Air Engines Regardless of the Altitude.*—Leslie V. Spencer.—It is well known that at high altitudes the power developed by the ordinary internal-combustion engine decreases materially because of the decrease of the oxygen content in the cylinder charge. The Bureau of Standards curve between the pressure and altitude at a temperature of 50° F. illustrates this fact very well. From it, it appears that at 20,000 feet an engine operates with an intake pressure of approximately half that at ground level, which affects both the proportion of the mixture and the fuel delivery through the nozzle.

In order to overcome this difficulty in the operation, engineers have turned to the idea of supercompressing the air sent to the carburetor so as to maintain as nearly as possible the ground-level pressure regardless of the height. Such supercompression has been given various names, of which the present writer recommends the term "supercharging." The function of a supercharging device is, however, not to increase the normal ground-level power up to the limit in altitude for which the supercharger is designed.

In Europe the method apparently most widely used is the turbo-supercompression, a good example of which is represented by the Rateau scheme developed by Professor Rateau in France.

The rotary compressor has been tried in competition with the centrifugal type of compressor by the British at the Royal Aircraft Establishment and has been discarded in favor of the latter. The centrifugal form of compressor, however, has proved the most desirable through having a minimum of working parts, being very compact for a given capacity and being capable of operating satisfactorily at top speed over long periods of time.



Barometric Pressure, Inches of Mercury.

Bureau of Standards Curve between Pressure and Altitude at Temperature of 50° F.

As to the methods of driving the compressor, there are three possibilities. It can be direct-connected with the engine just as a magneto, possibly with a gear train to step up the speed of the compressor rotor.

Also the compressor might be driven by a small steam turbine, the steam being produced by the exhaust-gas heat. The third alternative is to drive the compressor impeller by means of an exhaust-gas turbine receiving its energy directly from the engine exhaust gas.

In England and Italy direct-connected means of drive through an intermediate gear train have been tried, but great difficulty was experienced in coping with the severe stresses developed in the rapidly operating mechanism due to sudden fluctuations in the speed of the engine.

Sandy Hook, Mantoloking and Cape May, N. J.; Cape Henlopen and Bethany Beach, Del.; Hog Island, Smith Island and Cape Henry, Va.; Cape Hatteras, Cape Lookout, Cape Fear, North Island, Bull Island and Morris Island, S. C.; St. Augustine and Key West, Fla. The gulf stations are at Burrwood, Pass a Loutre and Grand Island, La.—*Naval Monthly*, May.

The recent developments of wireless telegraphy have required the use of more powerful Hertzian waves than had been sent out by any station up to the time of the war. There are present, therefore, in the ether permeating and surrounding the atmosphere, numerous trains of waves traveling in all directions. It is altogether possible that one of these sets or a set resulting from a combination of several of them should come in contact with a number of conducting bodies so arranged in a casual manner as to form a Hertzian resonator of the required inductance, capacity and resistance to respond to the passing train. There would then be an ether wave excited in the system, a spark would be produced and a fire probably caused as the result of the passage of the wave.

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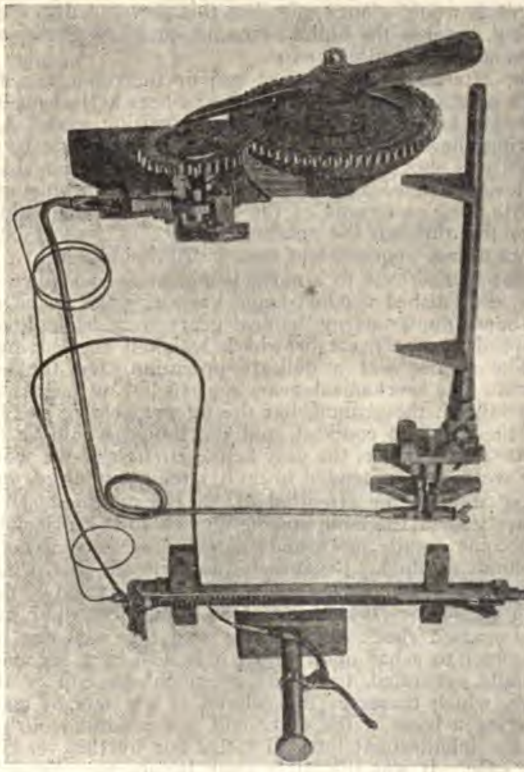
The history of the gear is romantic in the extreme. When the war started in 1914 no one beyond the novelists of perfervid imagination had any idea that aerial combat would develop to any great extent. The first pilots were chivalrous fellows. A Hun flier darting past a British or French machine would wave his hand genially, and receive a cheery salutation in return. Airplanes were solely for reconnaissance purposes.

Then, one day, a Hun, with villainous intent, pulled out a revolver and took a pot shot at a Britisher. The Englishman was surprised; he hadn't



THE GEAR FOR SHOOTING BETWEEN THE BLADES OF THE PROPELLER BY MEANS OF FLUID PRESSURE, SHOWING ALL THE WORKING PARTS.

thought of that. From that time the war in the air was on; revolver duels became common enough. No one was ever hit, but it was good sport. Even when a British pilot endeavored to make the game a bit more exciting by taking a shotgun aloft with him, and when the Huns retaliated, these weapons were found to be little more dangerous than their predecessors—though it is on record that one enemy machine was thus brought down.

Eventually a pilot, more daring than the rest, conceived the idea of using a machine gun. The Lewis, being light and exceedingly mobile, was the first choice. It was a great improvement, and all parties concerned

recognized it as such from the first. Planes began to carry machine guns as a matter of course; and the only drawback was the limited area in which the gun could be fired—only at right angles to the direction in which the machine was flying, in the majority of instances.

One day a pilot took a chance and fired straight ahead through the propeller. It was a risky proposition; but on landing it was found that comparatively few of the shots had hit the blade—about 4 per cent to be exact. It was, however, expensive as well as dangerous, with propellers costing $100 and more. So the next step was to armor-plate the blades so that the bullets would glance off. But this threatened to put a stop to formation flying, because the bullets, ricocheting in all directions, were as much of a menace to friend as to foe.

One summer afternoon, three years ago or thereabouts, a flight commander on the western front was surprised to hear a Hun plane overhead rattling off bursts of 40 or 50 shots with surprising ease. A pilot was sent up to bring the stranger in, and by great good luck he succeeded. When the Hun was shot down it was discovered that a novel contrivance of rods and levers had been fitted to the engine synchronizing the firing of the gun with the revolutions of the propeller, thereby making it altogether safe to fire through the rotating blades. It was at best a crude contrivance, but a vast improvement over indiscriminate fire.

This gear was turned over to a naval lieutenant who made a number of improvements, the finished product being known as the Scarff gear. The idea once in hand, numerous mechanical gears were brought out, but all were handicapped by one great drawback which it seemed impossible to overcome. The timing was a delicate operation, and the adjustments necessarily fine. The mechanical gear, constructed of metal parts, could be timed perfectly on the ground, but the intense cold of the higher altitudes caused the metal to contract, and the timing would be thrown out of adjustment. Furthermore, the very active friction of the working parts caused severe wear, and so tended to nullify the accuracy of operation.

The problem came to the attention of M. Constantinesco, a Rumanian by birth, naturalized in England, and he applied to it a principle in which he had just become greatly interested—namely, the transmission of power through a column of fluid. Because he encountered this principle while experimenting with sound waves under water, he named it the "sonic" principle. He emphasizes that it is not as though the fluid were a rigid column, and imparted shock in the same way that a sledge imparts the blow of a hammer to a bar upon which it is held by a second workman. There is actually generated, by an impact upon one end of the column, pressure wave, which traverses the column at the rate of 4900 feet per second, delivering a blow at the other end, not instantaneously, but after the lapse of the infinitesimal interval called for by this velocity and the length of the tube. It was doubtless their failure to appreciate that the outfit did not constitute a rigid system that kept the Germans from learning how to operate it—for its advantages are so marked that had they been able to unravel the secret, they would surely have used it.

M. Constantinesco's apparatus consists essentially, as our drawing shows, of a copper pipe filled with oil, at one end of which is a piston and at the other a pushrod to operate the trigger. The piston is connected with the propeller shaft by a gear and a cam. At the proper instant in each rotation of the propeller, the hump on the cam drives the piston down upon the end of the oil column, which is under a pressure of 150 pounds. Through this compressed column the shock of the piston blow travels as a pressure wave; and when it reaches the other end it operates the firing mechanism. The rotation of the propeller generates 40 to 60 of these wave impulses per second, with no friction except the very slight amount to be found between the gear and the cam.

It is, of course, not desired that the gun begin firing the moment the pilot takes the air, and continue until he makes his landing and stops his engine. So some means of control must be provided, and this is made possible by the necessity of having the oil column under pressure before it will transmit an effective blow. A small chamber is provided, connected with the copper pipe, and normally the oil occupies partly this chamber and partly the pipe. When it is desired to set the gun going, the pilot throws a small lever connected with his joy-stick, and this, with the aid of the spring shown in the reservoir, expels the oil from the reservoir, forces it out into the pipe, and puts it under pressure there. Then things begin to happen in the oil column, and the gun begins to speak.—*Scientific American*, 5/17.

DESCRIPTION OF "C-5."—The *C-5* is a twin-engine non-rigid airship of the *C* class, powered with two 125-horse-power union engines. Envelope No. E 106, manufactured by the Goodyear Tire and Rubber Company, Akron, Ohio; car No. A 4126, manufactured by the Burgess Company, Marblehead, Mass. The specifications follow:

Envelope displacement, approximately 178,000 cubic feet.
Envelope length, 192 feet.
Envelope diameter, 41 feet, 9 inches.
Normal speed, 50 miles per hour.
Endurance at normal speed, 10 hours.
Useful load, 4000 pounds.
Crew, six men.
Maximum attainable height, 8600 feet.
Car length, 400.
Fuel consumption approximately ten gallons per hour, at a speed of 42 miles per hour.—*N. Y. Times*, 5/13.

PROMOTING AERIAL NAVIGATION.—A comprehensive program to establish air terminals in at least 32 cities and towns for military, postal and commercial purposes outlined by Major General Charles T. Menoher, director of the air service of the United States Army, to representatives of many states and municipalities at the Southern aeronautical congress, Macon, Ga., has been announced as the government's official plan for cooperating with cities wishing to promote aerial navigation.

Simultaneously it was made known that the air service hopes soon to aid in laying out municipal flying fields wherever local conditions seem to warrant it, and where the municipality will bear expenses necessary in procuring personnel and maintaining the field and equipment, exclusive of airplanes.

At the present the army air service, primarily interested in military aviation, and the Postoffice Department, chiefly concerned with extension of aerial mail facilities, are jointly presenting the project to municipalities because the establishment of landing fields throughout the country will benefit the government as well as cities and towns.

The government has adopted the following general policy:

The air service and Postoffice Department will cooperate fully in establishing municipal landing fields.

The air service will select the landing fields in cooperation with municipal representatives.

The establishment of the field will be made in accordance with articles of agreement to be entered into between the United States Government and the municipality.

At present the government can cooperate only in the establishment of municipal flying fields at cities where the Postoffice Department has

established an aerial mail station, and where the air service cross-country routes require immediate stations. A study of the immediate requirements would indicate that the establishment of municipal flying fields will be confined at present to the following cities and towns: Boston, Mass.; New York, N. Y.; Richmond, Va.; Raleigh, N. C.; Columbia, S. C.; Augusta, Ga.; Macon, Ga.; Atlanta, Ga.; Kissimee, Fla.; Mobile, Ala.; New Orleans, La.; Baton Rouge, La.; Beaumont, Texas; Flatonia, Texas; El Paso, Texas; Texarkana, Texas; Columbus, Ohio; Tucson, Ariz.; Phoenix, Ariz.; Yuma, Ariz.; Bakersfield, Calif.; Fresno, Calif.; Buffalo, N. Y.; Syracuse, N. Y.; Albany, N. Y.; Columbus, N. Mex.; Kansas City, Mo.; Oklahoma City, Okla.; Uniontown, Pa.; Daytona, Fla.; Cleveland, Ohio, and Chicago, Ill.—*Army and Navy Register*, 5/10.

DESCRIPTION OF "N-C" SEAPLANES.—Wing span from tip to tip, 126 feet.

Upper wing from tip to tip, 114 feet.

Aileron projections beyond wing tips, 6 feet on either side.

Lower wing span, 94 feet.

Width of wings, 12 feet.

Distance between wings, 14 feet at center and 12 feet at outer tips of lower wing.

Over-all length from front end to the rear end, 68 feet 3½ inches.

Length of hull, 44 feet 9 inches.

Wing area, 2380 square feet.

Weight of flying boat (empty), including wireless installation and all navigating instruments, 15,100 pounds.

Weight full load flying condition, 28,500 pounds.

Percentage of useful load to total load, that is, load not a portion of structure or equipment, 47 per cent.

Weight carried per square foot of wing surface, 12 pounds.

Estimated speed at full load, 79 nautical miles per hour.

Estimated speed at light load, 84 nautical miles per hour.

Horse-power of four liberty engines, 1600 horse-power.

Number of gasoline tanks, nine in hull, one in upper wing above boat hull.

Capacity of gasoline tanks, 200 gallons for each hull tank and 90 gallons for gravity feed tank in upper wing.

Weight of gasoline system, 6 pounds per gallon of gasoline.

Weight of engines, 825 pounds each.

Weight of boat hull (empty), 2650 pounds.

Area of ailerons, 265 square feet.

Area of stabilizers, 267.6 square feet.

Area of elevators, 240.1 square feet.

Area of rudders, 69 square feet.

Displacement of wing pontoons, 1800 pounds each.

Weight of wing tip pontoons, 95-pounds each.

Gasoline pumps are wind driven by small wooden propellers and are in duplicate, an auxiliary hand-operated gasoline pump is provided.

Flying control is of the dual control Deperdussin system with side-by-side seating.

Pilots are in hull just forward of gasoline tanks.

Complete sets of instruments provided for pilots, including one compass for each pilot.

Navigating station is in front end of bott hull. Navigator is provided with chart board, charts, and ordinary navigating instruments, including compass and sextant.

Complete wireless installation, including telegraph and telephone and wireless direction indicator, is provided. System should give a radius of approximately 300 miles while in the air and of 100 to 150 miles while on the water.

Electric current is furnished by electric generator operated by a wind-driven propellor. Current is delivered to storage batteries. In addition to operating wireless set, storage batteries operate complete lighting system for interior of boat and for wing tip and tail lights as well as lights for night landing.

Wireless operator and engineer are located in main after compartment just aft of gasoline tanks. Each is provided with complete instrument board. Each of these operators has a cylindrical upholstered stool with back rest weighing 5 pounds complete, in the interior of which can be stored the small hand tools required for emergency work.

Cruising speed of boats, about 72 miles per hour.

Gasoline consumption at cruising speed, about 650 pounds average per hour.

Total gasoline carried, about 11,400 pounds.

Cruising radius without wind, about 1476 nautical miles.

Lubricating oil capacity, about 900 pounds.

Crew and provisions, about 1000 pounds.

Crew, five men—two pilots, one navigator, one wireless operator, and one engineer.

Main structure is of Western spruce.

Metal wing fittings and structural fittings in general are of crome vanadium steel of an ultimate strength of 150,000 pounds per square inch.

All flying and landing and control wires are of standard woven airplane cord wire.

Wing covering is linen treated with the ordinary airplane fabric dopes.

Gasoline tanks are of aluminum and gasoline piping is partly of aluminum and partly of copper.

Streamlining forms about wing struts are of micarta. Streamlining of flying and landing wires is of rubber covered with rubberized fabric.

Main keels of boat hulls are of oak or of rock elm. Hull structure is in general of spruce. Planking is of spruce or of cedar. Turtle-back covering is of cedar or of cottonwood birch three-ply veneer.

Cowling around engine nacelles is aluminum.

Four liquid fire extinguishers are carried in each boat hull.

Access to any portion of the boat hull by means of wing passages or to any portion of the power plant by means of hatches in the boat hull may be had either while on the water or while in the air.

All control surfaces, such as ailerons, rudders, and elevators, are balanced by a portion of the area forward of the pivoting points in order to relieve the work of the pilots.—*N. Y. Times*, 5/7.

PARACHUTE DEMONSTRATION.—The first public demonstration of "Life preservers of the air" was staged as one of the special features of the Second Pan-American Aeronautical Convention on May 3.

Lieut. Jean Ors, the noted French aeronaut, whose genius is responsible for the newest aerial safety device, ascended in an aeroplane piloted by Eddie Stinson. As the machine attained a speed of 80 miles an hour and an altitude of 500 feet over the heads of the beholders, Lieut. Ors, who occupied the seat directly behind the pilot, stepped over the cowl and leaped into space, releasing the air life preserver, which is a new type of parachute, by the jerk of the main suspending rope as he went over the side.

Stinson and his aeroplane sailed on in the straightaway. Crowds below caught the flash of Lieut. Ors' body as it was catapulted from the machine by the tremendous speed of the aeroplane. In a split second the umbrella-shaped top of the parachute spread out in a white canopy of safety over his head. Twenty-five feet below, suspended by the guide ropes leading down from the fringe of the "umbrella," Lieut. Ors' plummet-like plunge

earthward was halted before he had descended fifty feet. There was no jerk. The wide spread of the parachute slowed up his descent as gradually as if brakes had been eased on slowly.—*Aerial Age Weekly*, 5/12.

MISCELLANEOUS

NAVY UNIFORM BOARD.—It is again rumored that a board of navy officers soon will be convened to consider questions pertaining to the uniform of the naval service. For one thing, the present uniform regulations have been amended so often that the present edition is something of a patchwork affair, and there is need for a general revision of them and issue in a new edition. Moreover, a number of changes in the attire continue to be urged. Since adoption of the double-breasted open-collared coat, many officers believe that the overcoat should be of corresponding form. Changes in the cap also have been recommended, in order to make it more distinctly naval in character and less like the form of that of the army. As no collar-marks appear on the new coat, there now is no way to distinguish between line warrant officers—boatswains, gunners and machinists—as all wear the star on the sleeve, and there is need for attention to this detail. The requirement does not affect the staff warrant officers, as, under the amended regulations, they wear their respective corps marks on the sleeve.—*Army and Navy Register*, 4/26.

ANALYSIS OF JAPANESE SHIPPING.—The Department of Communications of Japan announces that the Japanese merchant marine to-day consists of 2578 steamers and 12,236 sailing vessels. The majority of the steamers are, however, coasting vessels not exceeding 1000 tons. Ocean-going steamers above 1000 tons number 599, their gross tonnage being 1,830,006 and their registered tonnage 1,154,377. Of this number six are above 10,000 tons and eight between 9000 and 10,000 tons. There is only one ship between 8000 and 9000 tons. There are 123 vessels between 4000 and 8000 tons. The smaller steamers between 1000 and 4000 tons are most numerous, numbering 366. The majority of sailing vessels are between 20 and 500 tons. There are only five ships between 500 and 1000 tons, while the vessels between 1000 and 2000 tons number only two.—*Shipping*, 5/3.

RED CROSS HOME SERVICE FINDS ALLOTTEES FOR BUREAU OF WAR RISK INSURANCE.—The Bureau of War Risk Insurance has asked the Red Cross to assist it in locating 37,226 persons to whom allotment checks have been sent and which were returned to the Bureau because of incorrect address, removal from old address, or similar reasons. Up to May 1, 9204 persons were found through the efforts of Home Service workers.

The local Red Cross Home Service Section has a list of all checks misdirected to addresses in the county of ————. All persons who have not received their allotment checks, and who believe they may be among those missent, are advised to call at or write to the Home Service office, which is located at ————, and which will assist them in securing their money.

CURRENT NAVAL AND PROFESSIONAL PAPERS

UNITED STATES

AMERICAN JOURNAL OF INTERNATIONAL LAW. **January.**—The Lack of Uniformity in the Law and Practice of States with Regard to Merchant Vessels, by *Fred K. Nielsen*. Private Property on the High Seas, by *Graham Bower*. Ships in Enemies' Ports as Prizes (editorial), by *C. N.*

Gregory. Pleasure and Racing Yachts in Prize Law (editorial), by *C. N. Gregory.* International Participation in Courts-Martial (editorial), by *George Grafton Wilson.* Prisoners of War Agreement between United States and Germany (supplement).

WORLD'S WORK. **May.**—American Admirals at Sea, by *Lieut. Francis T. Hunter,* U. S. N. R. F.

REVIEW OF REVIEWS. America's Aviation Policy, by Rear-Admiral Robert E. Peary.

SCIENTIFIC AMERICAN. **May 3.**—Increasing Visibility through Knowledge of Camouflage, by *Robert G. Sherrett.* Our Latest Dreadnought *Idaho.* **May 10.**—Sound Ranging Devices. What the Weather Man Thinks of Ocean Flying, by *Willis Rey Gregg,* U. S. Weather Bureau.

AERIAL AGE. **May 19.**—*Glenn H. Curtiss* on the Transatlantic Flight. Principles of Aeroplane Construction, by *Captain James Vernon Martin.*

GREAT BRITAIN

NINETEENTH CENTURY AND AFTER. **April.**—The New Light on Jutland (with diagrams), by *Sir George Aston.*

FORTNIGHTLY REVIEW. **April.**—The Truth about the Battle of Jutland, by *Archibald Hurd.*

UNITED SERVICE MAGAZINE. **April.**—Some Reflections on Submarines, by *Rooinek.* Wanted—A British-American Naval Entente, by *Charles E. T. Stuart-Linton.*

into a free city under the League, and various commissions for plebiscites in Malmedy, Schleswig, and East Prussia. Among those to carry out the Peace Treaty are the Reparations, Military, Naval, Air, Financial, and Economic Commissions, the International High Court and Military Tribunals to Fix Responsibilities, and a series of bodies for the control of international rivers.

Certain problems are left for solution between the allied and associated powers, notably the details of the disposition of the German fleet and cables, the former German colonies, and the values paid in reparation. Certain other problems, such as the laws of the air and the opium, arms, and liquor traffic, are either agreed to in detail or set for early international action.—*N. Y. Times*, 8/5.

GERMANY'S LOST TERRITORY.—It is estimated that the Peace Treaty will deprive Germany of 1,075,607 square miles of territory (47,787 in Europe) and 15,000,000 people (12,041,603 natives in former colonial possessions). A table of territorial losses follows:

IN EUROPE	Square miles
Alsace Lorraine, to be ceded to France	5,680
Eupen and Malmedy, circles, to Belgium	382
Parts of Silesia, Posen, and West Prussia, to Poland	27,683
Danzig internationalized areas	729
Sarre coal basin, to France	738
Southeastern third of East Prussia, nationality to be determined by plebiscite	5,785
Part of Schleswig, nationality to be determined by popular vote, with view to reversion to Denmark	2,787
Total in Europe, exclusive of Russia	47,787
AFRICAN COLONIES AND DEPENDENCIES	
Togo	33,700
Kamerun	191,130
Southwest Africa	322,450
East Africa	384,100
Total African possessions	931,460
COLONY IN ASIA	
Kiau-Chau	200
COLONIES IN THE PACIFIC	
Kaiser Wilhelm's Land	70,000
Bismarck Archipelago	20,000
Caroline and Pelew Islands	560
Marianne Islands	250
Solomon Islands	4,200
Marshall Islands, &c.	150
Samoan Island of Savaii	660
Samoan Island of Upolu	340
Total Pacific possessions	96,160
Total foreign dependencies	1,027,820
Grand total in Europe and colonies	1,075,607

GERMAN NOTES AND PROTESTS.—In the period of two weeks pending action on the Peace Treaty, the German delegates presented a number of long notes and protests. The Allies appointed 13 committees to consider and reply to these proposals, the members, however, including none of the "Council of Four," who turned their attention to the Austrian peace terms. The protests presented by Germany included the following:

(1) Note on *repatriation of prisoners,* submitted May 11, expressing satisfaction that the Allied Powers recognized in principle the repatriation of

GERMANY'S LOST TERRITORY.

German prisoners without delay, and proposing that details be taken up at once by joint commissions.

(2) Note on *international labor legislation,* submitted May 11, proposing a conference at Versailles of representatives of trade unions of all the contracting powers, the proceedings to be based on the proposals of the International Trade Union Conference held at Berne in February. In a reply dated May 14, M. Clemenceau conveyed the opinion of the Allied and Associated Powers to the effect that labor legislation was sufficiently provided for in Part XIII of the Peace Treaty which created an international labor organization, the first session of which would be held in Washington, in October, 1919.

(3) Note on *economic terms,* declaring that 15,000,000 people in Germany were dependent on foreign trade and foreign raw materials, that Germany could not support more than 40,000,000 on her own resources, and that the terms of treaty would mean economic ruin and starvation.

(4) Note on *territorial questions,* admitting the principle of self-determination in certain instances, but objecting to the sacrifice of territory populated by Germans, and particularly against the Sarre Valley arrangement, the transfer of territory to Belgium, and the evacuation of part of Schleswig.

(5) Note on *reparations,* assenting to payment but not because of responsibility for the war.

(6) A note submitting a *German plan for a league of nations,* differing from the Allied plan chiefly in that it provided for the immediate inclusion of all belligerents. This plan was submitted to the Committee on a League of Nations, which found its merits sufficiently paralleled in the plan already incorporated in the Peace Treaty.

OPPOSITION TO TREATY IN GERMANY.—Following the announcement of peace terms, a week of mourning was officially decreed in Germany, the purpose of which was at least in part to lend support to the protests of the German delegates. President Ebert on May 11 declared the treaty a "monstrous document" and that Germany's hopes of America had proved vain. Chancellor Scheidemann in the National Assembly on May 12 pronounced the terms "unacceptable," finding one hundred clauses beginning with "Germany renounces." The Independent Socialists, on the other hand, insisted that the terms should be accepted and peace declared, though their leader, Hugo Haase, refused to form a government to assume responsibility for signing the treaty.

TREATY VALID WHEN THREE ALLIED POWERS RATIFY.—Paris, May 16.—The German peace treaty, it developed to-day, contains a clause, which has not yet been made public, providing that ratification by Germany and three of the principal associated powers will bring the treaty in force between the ratifying parties, enabling the immediate resumption of trade.

It was pointed out in connection with this stipulation that any nation which withheld ratification after three of the principal powers had ratified would be at a disadvantage in a commercial way, from the fact that the ratifying powers would be able to resume trade relations with Germany at once, while the states which delayed would have no such privilege.—*N. Y. Times,* 17/5.

FRENCH TO SUPPLY ARMY OF OCCUPATION.—Paris, May 8.—Neither the United States nor Great Britain will maintain any part of the armies of occupation which by the terms of the treaty will remain on the Rhine for at least 15 years. The occupation of the left bank of the Rhine will be effected by French and Belgian troops, the great majority, of course, being French. These two nations receive practically all of the indemnity for the collection of which allied troops are to be retained on German territory. It was not the wish of Marshal Foch and the French peace delegation that this arrangement be made.

PROPOSED AMERICAN UNDERSTANDING WITH FRANCE

On May 8 the following official statement was issued at Paris:

"In addition to the securities afforded in the treaty of peace, the President of the United States has pledged himself to propose to the Senate of the United States, and the Prime Minister of Great Britain has pledged himself to propose to the Parliament of Great Britain, an engagement, subject to the approval of the Council of the League of Nations, to come immediately to the assistance of France in case of unprovoked attack by Germany."

It was later reported that this pledge on the part of the President of the United States was embodied in a letter to Premier Clemenceau, and that the proposal would be presented to the Senate in a form suggesting a defensive alliance.

REVISED LEAGUE OF NATIONS COVENANT HEADS PEACE TREATY

The revised covenant of the League of Nations was adopted at a plenary session of the Peace Conference on April 28 without division and without amendments, and is given first place as Section I in the peace treaty.

The document as it there appears (for original see U. S. NAVAL INSTITUTE PROCEEDINGS, March, 1919) is outlined as follows in the official summary:

SECTION I.—*League of Nations.*—The covenant of the League of Nations constitutes Section I of the peace treaty, which places upon the League many specific, in addition to its general, duties. It may question Germany at any time for a violation of the neutralized zone east of the Rhine as a threat against the world's peace. It will appoint three of the five members of the Sarre Commission, oversee its régime, and carry out the plebiscite. It will appoint the High Commissioner of Danzig, guarantee the independence of the free city, and arrange for treaties between Danzig and Germay and Poland. It will work out the mandatory system to be applied to the former German colonies, and act as a final court in part of the plebiscites of the Belgian-German frontier, and in disputes as to the Kiel Canal, and decide certain of the economic and financial problems. An International Conference on Labor is to be held in October under its direction, and another on the international control of ports, waterways, and railways is foreshadowed.

Membership.—The members of the League will be the signatories of the covenant and other states invited to accede who must lodge a declaration of accession without reservation within two months. A new state, dominion, or colony may be admitted, provided its admission is agreed by two-thirds of the assembly. A state may withdraw upon giving two years' notice, if it has fulfilled all its international obligations.

Secretariat.—A permanent secretariat will be established at the seat of the League, which will be at Geneva.

Assembly.—The Assembly will consist of representatives of the members of the League, and will meet at stated intervals. Voting will be by states. Each member will have one vote and not more than three representatives.

Council.—The Council will consist of representatives of the Five Great Allied Powers, together with representatives of four members selected by the Assembly from time to time; it may co-opt additional states and will meet at least once a year. Members not represented will be invited to send

a representative when questions affecting their interests are discussed. Voting will be by states. Each state will have one vote and not more than one representative. A decision taken by the Assembly and Council must be unanimous except in regard to procedure, and in certain cases specified in the covenant and in the treaty, where decisions will be by a majority.

Armaments.—The Council will formulate plans for a reduction of armaments for consideration and adoption. These plans will be revised every ten years. Once they are adopted, no member must exceed the armaments fixed without the concurrence of the Council. All members will exchange full information as to armaments and programs, and a permanent commission will advise the Council on military and naval questions.

Preventing of War.—Upon any war, or threat of war, the Council will meet to consider what common action shall be taken. Members are pledged to submit matters of dispute to arbitration or inquiry and not to resort to war until three months after the award. Members agree to carry out the arbitral award and not to go to war with any party to the dispute which complies with it. If a member fails to carry out the award, the Council will propose the necessary measures. The Council will formulate plans for the establishment of a permanent court of international justice to determine international disputes or to give advisory opinions. Members who do not submit their case to arbitration must accept the jurisdiction of the Assembly. If the Council, less the parties to the dispute, is unanimously agreed upon the rights of it, the members agree that they will not go to war with any party to the dispute which complies with its recommendations. In this case, a recommendation, by the Assembly, concurred in by all its members represented on the Council and a simple majority of the rest, less the parties to the dispute, will have the force of a unanimous recommendation by the Council. In either case, if the necessary agreement cannot be secured, the members reserve the right to take such [action?] as may be necessary for the maintenance of right and justice. Members resorting to war in disregard of the covenant will immediately be debarred from all intercourse with other members. The Council will in such cases consider what military or naval action can be taken by the League collectively for the protection of the covenants and will afford facilities to members co-operating in this enterprise.

Validity of Treaties.—All treaties or international engagements concluded after the institution of the League will be registered with the secretariat and published. The Assembly may from time to time advise members to reconsider treaties which have become inapplicable, or involve danger to peace. The covenant abrogates all obligations between members inconsistent with its terms, but nothing in it shall affect the validity of international engagements such as treaties of arbitration or regional understandings like the Monroe Doctrine for securing the maintenance of peace.

The Mandatory System.—The tutelage of nations not yet able to stand by themselves will be intrusted to advanced nations who are best fitted to undertake it. The covenant recognizes three different stages of development requiring different kinds of mandatories:

(*a*) Communities like those belonging to the Turkish Empire, which can be provisionally recognized as independent, subject to advice and assistance for a mandatory in whose selection they would be allowed a voice.

(*b*) Communities like those of Central Africa, to be administered by the mandatory under conditions generally approved by the members of the League, where equal opportunities for trade will be allowed to all members; certain abuses, such as trade in slaves, arms, and liquor will be prohibited, and the construction of military and naval bases and the introduction of compulsory military training will be disallowed.

(*c*) Other communities, such as Southwest Africa and the South Pacific Islands, but administered under the laws of the mandatory as integral por-

An invitation to send delegates to Paris was extended to the Soviet government of Hungary, which however did not accept. The powers negotiating with Austria include only those who declared war upon or broke diplomatic relations with Austria-Hungary.

GERMANY

RED RULE IN MUNICH OVERTHROWN.—The overthrow of the Soviet rule in Munich was finally accomplished on May 1 by forces of the Hoffmann government assisted by troops supplied by the German Republic. About 150 were killed in the fighting, and 5000 arrests were made later, but many of the Soviet leaders, including Dr. Levien, escaped.

RUSSIA

KOLCHAK PLANS ADVANCE ON MOSCOW.—According to an interview with Admiral Kolchak published in the *Petit Parisien* of May 13, the All-Russian Government at Omsk is planning a move on Moscow during the coming summer, together with the destruction of the Soviet army. Aid from the Allies was requested in the form of supplies, and a more stringent blockade of Soviet Russia. The Admiral renewed his assurance that the National Assembly would be given control upon final victory.

In the meantime the plan to send supplies of food to Russia by means of a neutral commission has been blocked by the refusal of the Lenine Government to accept the terms accompanying the offer.

FINLAND GOVERNMENT RECOGNIZED.—On May 5 the Council of Foreign Ministers at Paris decided to extend recognition to the *de facto* government of Finland under certain conditions which were not disclosed. Recognition by Great Britain and the United States was officially announced on May 6. Subsequent reports gave information of the advance of a Finnish army towards Petrograd, under the leadership of General Mannerheim, and of a warning to residents of Petrograd issued by the Soviet Government.

FAR EAST

JAPAN RECEIVES CONCESSIONS IN SHANTUNG.—According to the terms of the Peace Treaty, Germany is required to renounce her share of the Boxer indemnity and all her property in the German concessions of Tientsin and Hankow. The summary of the treaty terms relating to Shantung reads:

"Germany cedes to Japan all rights, titles, and privileges, notably as to Kiao-Chau, and the railroads, mines, and cables acquired by her treaty with China of March 6, 1897, by and other agreements as to Shantung. All German rights to the railroad from Tsing-tao to Tsinan-fu, including all facilities and mining rights and rights of exploitation, pass equally to Japan, and the cables from Tsing-tao to Shanghai and Che-foo, the cables free of all charges. All German State property, movable and immovable, in Kiao-Chau is acquired by Japan free of all charges."

SOVEREIGNTY RESTORED TO CHINA.—In a statement issued on May 5, Baron Makino, head of the Japanese delegation at the Peace Conference,

declared that Japan had agreed to return full sovereignty to China, retaining only the economic privileges granted Germany and the right to establish a settlement under the usual conditions at Tsing-tao. The railway in the province, which is to become a joint Chino-Japanese undertaking, would be guarded by Japanese police forces only to the extent necessary for security of traffic.

The Chinese delegates at the Peace Conference took the ground that by China's entry into the war, all special agreements made with Japan were canceled, and an entirely new settlement of the question should be attempted. This attitude was supported by the Chinese Parliament, which on April 30 passed a resolution directing the Foreign Office to protest against the proposed transfer to Japan.

It is pointed out by Japan that Germany was driven out of Kiao-Chau almost entirely by Japanese forces, while China was still a neutral, and hindered by protests; and that the proposed settlement is in accordance with Japan's secret agreement with the Allied Powers made in February, 1917.

NEW CONSORTIUM FOR CHINESE LOAN.—A new consortium "for undertaking joint financial, administrative, and industrial loans to the Chinese Government" was organized at Paris on May 12 by American, French, British, and Japanese bankers, Mr. Thomas W. Lamont, of J. P. Morgan & Co., presiding. The meeting was called at the instance of the United States, and is said to have resulted from a proposal of Japan to advance $15,000,000 to China secured by a first lien on the Chinese Government's tobacco monopoly. The amount of the forthcoming loan is put at $100,000,000, in four equal annual installments.

Washington, May 12.—The announcement in Paris to-day of the formation of a new consortium for loaning money to China was confirmed officially here. The old consortium will expire on June 18. Four American banks were originally included in it, but they withdrew because of the adverse policy of the State Department under William J. Bryan. Germany was excluded from the existing consortium by the war. Russia's collapse took that country out, and the strain of the war caused Belgium to retire. Japan was never a member of it.

In the new consortium, 37 American banks will participate, following President Wilson's idea of a more democratic arrangement, whereby a larger number of each country's financial institutions may be represented than was the case with the expiring consortium.

American participation in the consortium results from a new policy adopted by the United States Government with respect to Chinese loans, which in effect is that, if the terms of the loan are just and the conditions fair, the government of the United States will assure the American banks participating, after the matter shall have been submitted to the State Department, that the United States will protect the interests secured in good faith.—*N. Y. Times*, 13/5.

REVIEW OF BOOKS

ON

SUBJECTS OF PROFESSIONAL INTEREST

"The Naval Architects' and Shipbuilders' Pocket Book." By Clement Mackrow and Lloyd Woodard. Twelfth Edition. 741 pages. (New York: The Norman W. Hanley Publishing Company.)

This is the 12th edition of Mackrow's "Naval Architect and Shipbuilders' Pocket Book," bearing the date of August 1, 1919. An extensive revision of the pocket book was made for the 11th edition, which appeared in January, 1916. Most of the work on the 11th edition was done by Mr. Mackrow himself who, however, died before its completion. It remained to Mr. Lloyd Woolard of the Royal Corps of Naval Constructors to complete Mr. Mackrow's unfinished work. The pocket book contains the usual treatment of the mathematics of engineering common to all handbooks, with such additional mathematics and tables as are specially applicable to naval construction. A chapter is also devoted to aeronautics. It is, perhaps, at first sight not obvious why a handbook on naval architecture should concern itself with the science of aeronautics. The inclusion of this subject is however logical, because the mathematics of stability, displacement, strength calculations, etc., are the same for aircraft as for ships, particularly for the lighter-than-air types of aircraft.

In an appendix to the 12th edition a number of pages are devoted to estimating the cost and weight of merchant vessels. While estimating the weight of structural steel has been covered in some detail, the article is hardly of much help in estimating costs. Reliable and usable data for estimating the cost of ship construction are still a conspicuous omission from handbooks and other treatises on naval construction. Data as to the cost per ton of building vessels in the past are of little use to the estimating department of a shipyard. Something more fundamental is needed. It should be possible to compile data giving the man hours required per ton, or other unit, to produce the various parts entering into the building of a ship. The man-hour unit eliminates fluctuations in wages and differences in local conditions. There will be a great demand for any book which treats the subject of cost estimating on this basis and it is hoped that some one will fill this long-felt need. Unfortunately, those who have the time and are interested in writing are usually not the ones who have access to cost data.

Mackrow's pocket book is more valuable to the British naval architect and draftsman than to the American user, as the data are based principally on British mill and engineering practice.

J. A. F.

main, a collection of concise narratives, based on official reports, logs and other authentic sources, covering practically the entire range of British submarine and anti-submarine activities during the present war, together with a chapter discussing the part the submarine played in the war policies of Great Britain and Germany; a chapter on "The Hunted," which contains an account by both sides of the *Fanning-Nicholson vs. U-58* engagement; and, in the closing chapter, an excellent account of the Zeebrugge and Ostend affairs. The illustrations have no particular merit and, considering the character of the binding and the quality of the paper used the price seems rather high.

L. A.

"Official Aero Blue Book and Directory, 1919." Henry Woodhouse, Editor. (Published by the Century Co., New York, at $5.00)

The handsome volume with the above high-sounding title contains a good deal of information interesting from a purely historical standpoint. In order to command the price at which it is sold, however, it has been padded with propaganda, advertisements (not confined to the advertising pages) and irrelevant pictures.

Although the book was not published until March, 1919, much of the material applies only to conditions existing during the war. In this connection I was interested in the advocacy, on page seven, of the Postal Air Service as a training for bombing aviators on account of the similarity (*sic*) between dropping mail bags and bombs. I hardly think that the postal aeroplanes will be forced to operate at the heights which were found necessary for bombing machines towards the close of the war.

Over 70 pages are devoted to the description in utmost detail of eight "airways," five transcontinental and three coastal, proposed by the Aero Club of America.

A chapter entitled "A Flight Across the Atlantic" is an attempt to anticipate the experiences of an actual crossing. In a foreword the editor has the good grace to state that it is an account of an "hypothetical" flight. When it originally appeared in *Flying* there was no such explanation and some of the London newspapers accepted the account at its face value, which is either a commentary upon the appalling lack of technical knowledge of the "aviation experts" of the journals or a great tribute to the imagination of the writer.

Following are chapters giving the histories of various sporting events beginning with the Gordon Bennett Aviation and Balloon Trophies. As these events were run under the auspices of the Fédération Aéronautique Internationale of which the Aero Club of America is the representative I expected that care would be taken to have the accounts correct if for no other reason than to justify the title of the book. I was disappointed however.

The history of the Gordon Bennett Aviation Trophy contains many errors in spelling and gross inaccuracies in the times. As an example, the time for

Latham, the third to finish, in the 20 kilometer 1909 race is given as 15 minutes 50⅗ seconds which would have tied him with the winner Glenn (not Glen) Curtiss. As a matter of fact, Latham took 17 minutes 32 seconds. Again, the record given for Prévost, the winner of the 1913 cup, is 200 kilometers in 50 minutes 45⅗ seconds. I happened to have witnessed this race, which was held at Rheims, and my records show that he took exactly nine minutes longer than the time stated. Such mistakes as these are really inexcusable in a book pretending to be "official."

In the history of the Gordon Bennett Balloon Trophy, written by Mr. Hawley, the races won by Americans are described in great detail, whereas those won by representatives of other nations are dismissed with a few lines. The 1912 race is referred to in the following quaint manner: ". . . . the seventh race for the cup will have been competed for before this is published (*sic*), and the club members all hope that the good team that is going to Germany to compete will bring the cup back to the Aero Club, as it is sadly missed from the trophy room after two years of possession." That is all.

For the benefit of the reader I should like to state that the 1912 race was won by the French representative Bienaimé.

Let us sincerely hope that if future editions of the book contain articles written in 1912 pains will at least be taken to edit them properly.

The remaining pages contain descriptions of the lesser contests, lists of qualified pilots and a directory of aeronautic organizations. Finally, there are given American and world's aviation records. These are stated to be only to December 31, 1915, but, in an effort to bring the list up to date, the flight of the *NC-1* seaplane with 51 (not 50) people and Captain Schroeder's height record of 28,900 feet are included.

This list contains very few mistakes, but why should there be any? With the exceptions noted above it could have been set up in type three years ago and proofread ever since.

J. J. I.

"*The Hatchet* of the U. S. S. *George Washington.*" Compiled by Captain Edwin T. Pollock, U. S. N., and Lieutenant (j. g.) Paul F. Bloomhardt, Chaplain Corps, U. S. N. Net proceeds to Navy Relief Society, Washington, D. C., from which copies may be obtained. Price $2.00.

The daily paper of the *George Washington,* published during nine eastward passages from February 21 to December 12, 1918, may now be had in a collected volume, each number an exact copy, even to printer's errors, of *The Hatchet* as it appeared "on the high seas." The errors, typographical or otherwise, in no way detract from the interest of the series, which, considering the difficulties and distracting responsibilities under which the editor, Chaplain Bloomhardt, and his corps of helpers labored, is a highly creditable journalistic achievement. News and humor mingle—the former in concise radio messages that recall the stirring events of the last year of the war; the latter with occasional effusions, such as the "Letters to Mable" and the "Badger Fight Hoax," which deserve their rescue from oblivion.

main, a collection of concise narratives, based on official reports, logs and other authentic sources, covering practically the entire range of British submarine and anti-submarine activities during the present war, together with a chapter discussing the part the submarine played in the war policies of Great Britain and Germany; a chapter on "The Hunted," which contains an account by both sides of the *Fanning-Nicholson vs. U-58* engagement; and, in the closing chapter, an excellent account of the Zeebrugge and Ostend affairs. The illustrations have no particular merit and, considering the character of the binding and the quality of the paper used, the price seems rather high.

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NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-sixth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be two dollars and fifty cents, all of which shall be for a year's subscription to the United States Naval Institute Proceedings, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

ARTICLE X

Sec. 2. One copy of the Proceedings, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The Proceedings are published monthly; subscription for non-members, \$3.00; enlisted men, U. S. Navy, \$2.50. Single copies, by purchase, 30 cents; issues preceding January, 1919, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ESSAY, 1920

A prize of two hundred dollars, with a gold medal, and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original essay on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the essay.

On the opposite page are given suggested topics. Essays are not limited to these topics and no additional weight will be given an essay in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original essays published in the PROCEEDINGS during 1919, which are deemed by the Board of Control to be of sufficient merit, will be passed upon by the Board during the month of January, 1920, and the award for the prize will be made by the Board of Control, voting by ballot.

2. No essay received after November 1 will be available for publication in 1919. Essays received subsequent to November 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best essay published during 1919 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more essays receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. It is requested that all essays be submitted typewritten and in duplicate; essays submitted written in longhand and in single copy will, however, receive equal consideration.

6. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

G. M. RAVENSCROFT,
Commander, U. S. N., Secretary and Treasurer.

TOPICS FOR ESSAYS

SUGGESTED BY REQUEST OF THE BOARD OF CONTROL

"Duties and Responsibilities of Subordinates with Special Reference to the Relations between Commanders-in-Chief and Chief of Naval Operations; Commanders-in-Chief and Force Commanders; Force Commanders and Division Commanders."

"Initiative of the Subordinate—Its True Meaning."

"Military Efficiency Dependent upon National Discipline."

"Governmental Organization for War."

"Naval Gunnery, Now and of the Future."

"Naval Policies."

"The Place of the Naval Officer in International Affairs."

"Moral Preparedness."

"Tact in Relation to Discipline."

"The Principles of Naval Administration in Support of War-Time Operations."

"Responsibilities and Duties of Naval and Military Officers of the United States in Educating and Informing the Public on Professional Matters."

"A Commission in The Navy: Its Meaning and the Obligations Which It Involves."

"The Relations of an Officer to his Subordinate, Both Commissioned and Enlisted."

"The True Meaning of the Expression 'An Officer and a Gentleman.'"

"Seen in the Light of Recent Events, What Should Be the United States Navy of the Future as Regards Types and Numbers of Ships."

"Probable Future Development of Surface-craft, Air-craft and Submarines and the Relation of these Types to Each Other and to Naval Warfare in General."

"The Grand Strategy of the Great War, with Especial Reference to Coördination, and Lack of Coördination, Between Naval and Military Forces."

"The Problem of Overseas Operations in the Light of Recent Developments."

"The Influence of Sea Power upon History as Illustrated by the Great War."

LIST OF PRIZE ESSAYS

"WHAT THE NAVY HAS BEEN THINKING ABOUT"

1879

Naval Education. Prize Essay, 1879. By Lieut. Commander A. D. Brown, U. S. N.

NAVAL EDUCATION. First Honorable Mention. By Lieut. Commander C. F. Goodrich, U. S. N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U. S. N.

1880

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U. S. N.

1881

The Type of (I) Armored Vessel, (II) Cruiser Best Suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U. S. N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U. S. N.

1882

Our Merchant Marine: The Causes of Its Decline and the Means to Be Taken for Its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. Kelley, U. S. N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U. S. N.

"SPERO MELIORA." Honorable Mention. By Lieut. Commander F. E. Chadwick, U. S. N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U. S. N.

1883

How May the Sphere of Usefulness of Naval Officers Be Extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U. S. N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U. S. N.

"CULIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U. S. N.

1884

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U. S. N.

1885

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U. S. N.

1886

What Changes in Organization and Drill Are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U. S. N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORTS FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U. S. N.

1887

The Naval Brigade: Its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins.

1888

Torpedoes. Prize Essay, 1888. By Lieut. Commander W. W. Reisinger, U. S. N.

1891

The Enlistment, Training and Organization of Crews for Our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U. S. N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U. S. N.

1892

Torpedo-boats: Their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894

The U. S. S. Vesuvius, with Special Reference to Her Pneumatic Battery. Prize Essay, 1894. By Lieut. Commander Seaton Schroeder, U. S. N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U. S. N.

1895

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut. Commander Richard Wainwright, U. S. N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U. S. N.

SUGGESTIONS FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U. S. N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U. S. N.

1896

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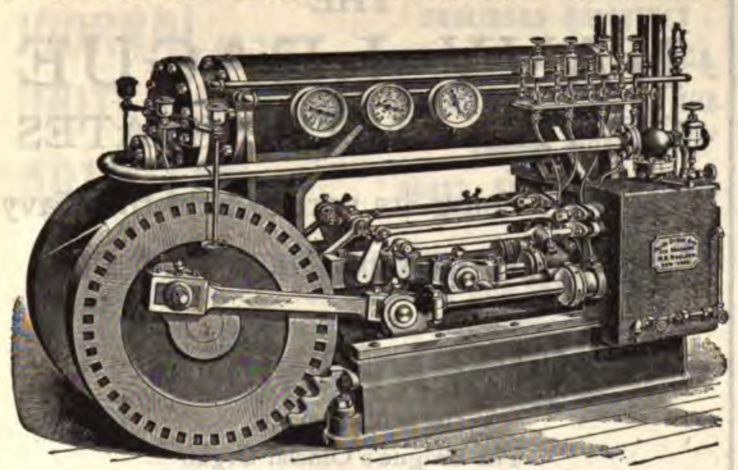

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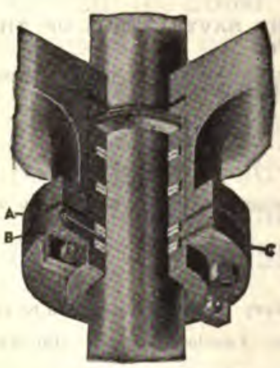

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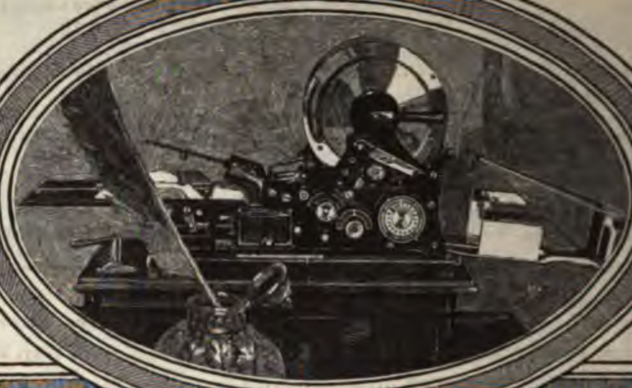

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